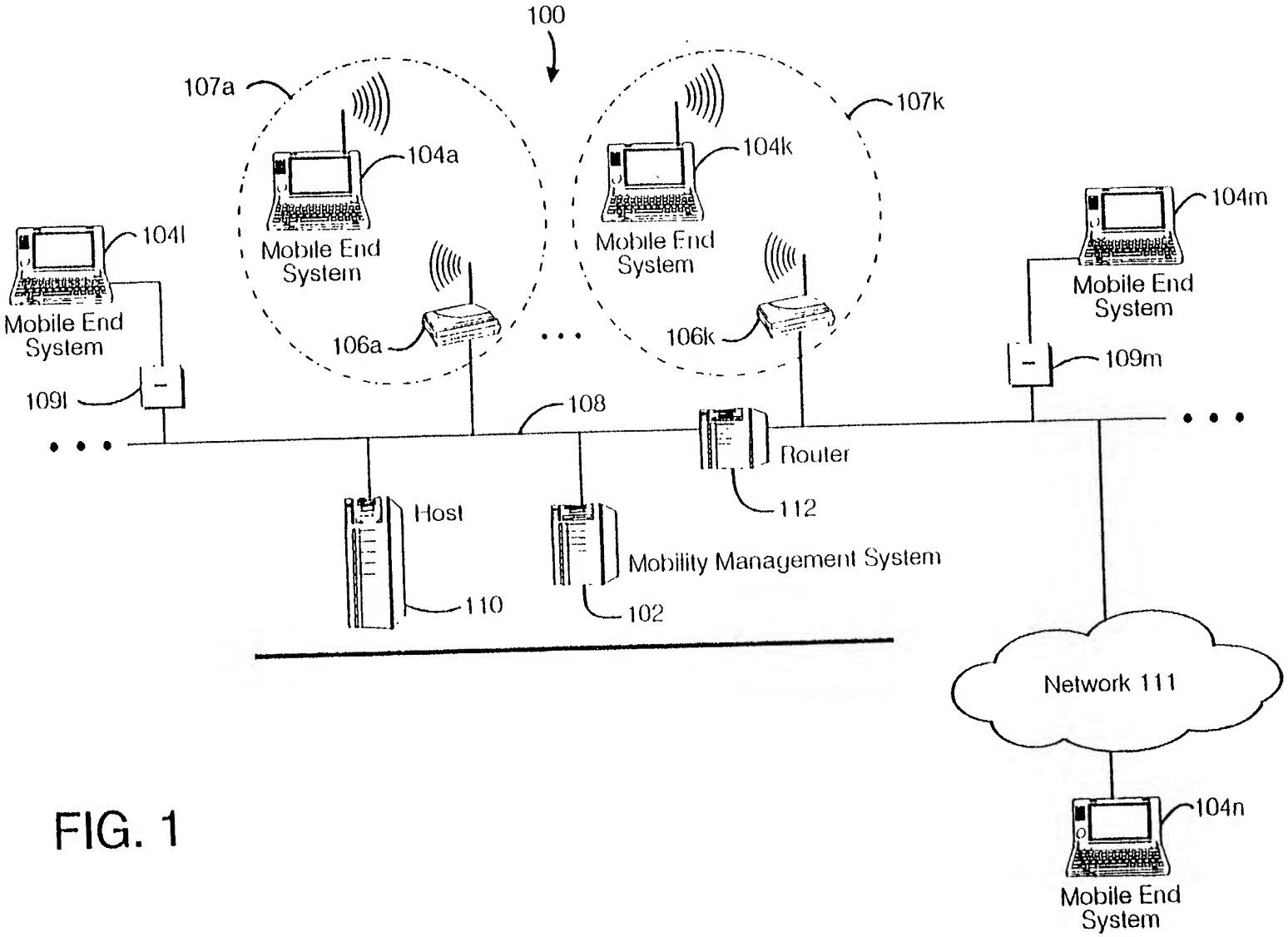

100
107a
107k
104a
104k
104m
104l
Mobile End System
Mobile End System
Mobile End System
Mobile End System
106a
106k
109m
109l
108
Router
112
Host
110
Mobility Management System
102
Network 111
104n
Mobile End System

FIG. 1

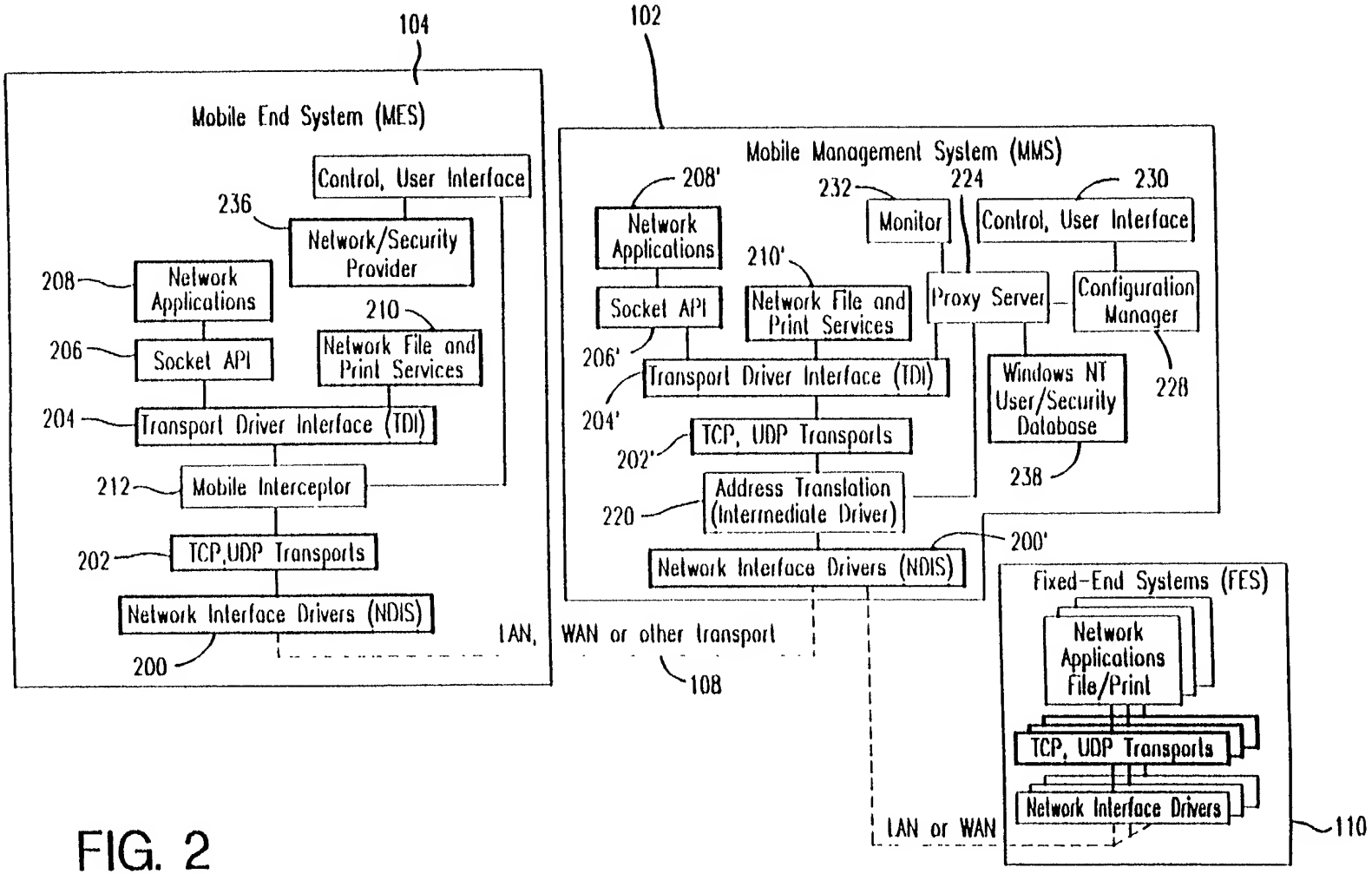

104
Mobile End System (MES)
Control, User Interface
236
Network/Security Provider
208
Network Applications
210
Network File and Print Services
206
Socket API
204
Transport Driver Interface (TDI)
212
Mobile Interceptor
202
TCP,UDP Transports
Network Interface Drivers (NDIS)
200
LAN,
102
Mobile Management System (MMS)
208'
Network Applications
232
Monitor
224
230
Control, User Interface
210'
Network File and Print Services
Proxy Server
Configuration Manager
228
Socket API
206'
Transport Driver Interface (TDI)
Windows NT User/Security Database
238
204'
TCP, UDP Transports
202'
Address Translation (Intermediate Driver)
220
200'
Network Interface Drivers (NDIS)
WAN or other transport
108
Fixed-End Systems (FES)
Network Applications File/Print
TCP, UDP Transports
Network Interface Drivers
LAN or WAN
110

FIG. 2

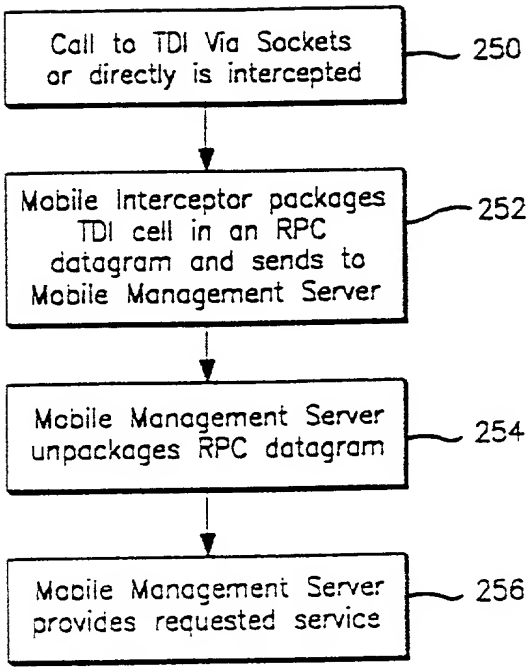

Call to TDI Via Sockets or directly is intercepted
250
Mobile Interceptor packages TDI cell in an RPC datagram and sends to Mobile Management Server
252
Mobile Management Server unpackages RPC datagram
254
Mobile Management Server provides requested service
256

FIG. 2A

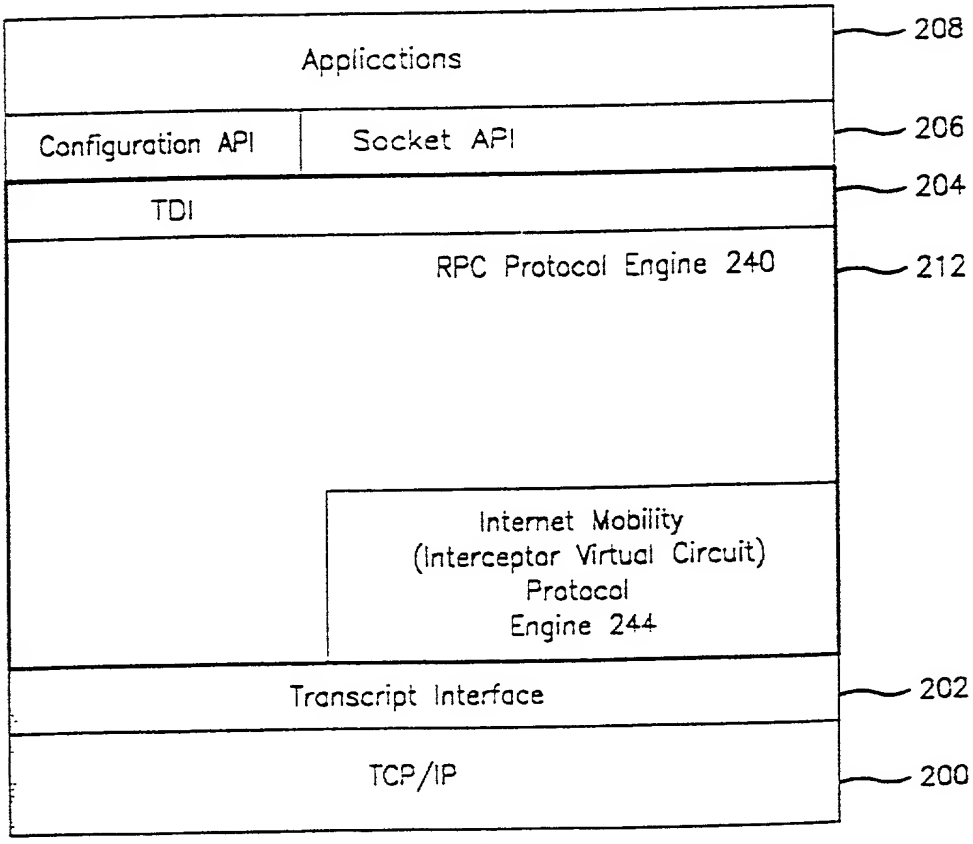

Applicctions
208
Configuration API
Socket API
206
TDI
204
RPC Protocol Engine 240
212
Internet Mobility (Interceptor Virtual Circuit) Protocol Engine 244
Transcript Interface
202
TCP/IP
200

FIG. 3

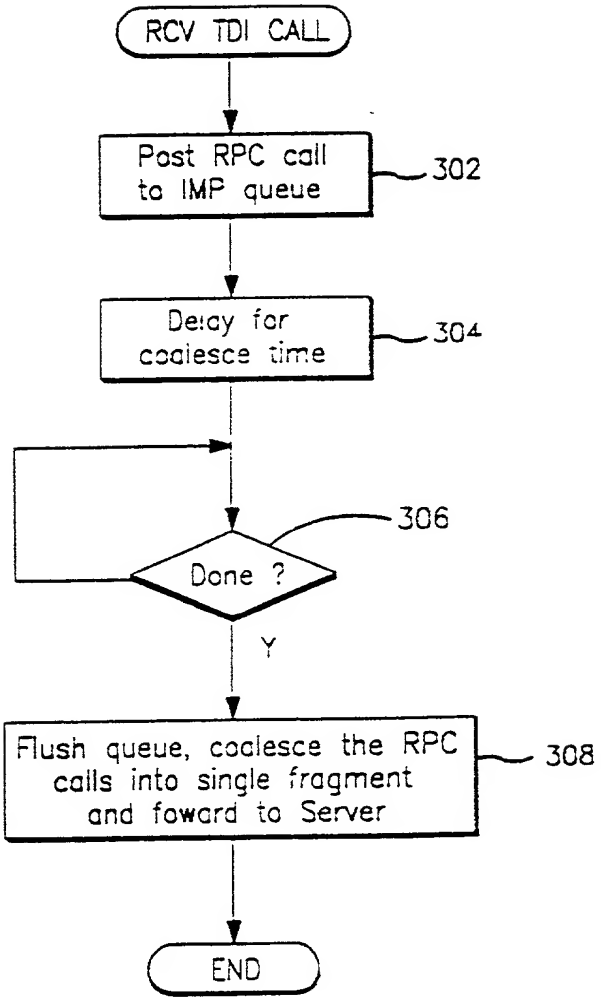

RCV TDI CALL
Post RPC call to IMP queue
302
Delay for coalesce time
304
306
Done ?
Y
Flush queue, coalesce the RPC calls into single fragment and foward to Server
308
END

FIG. 3A

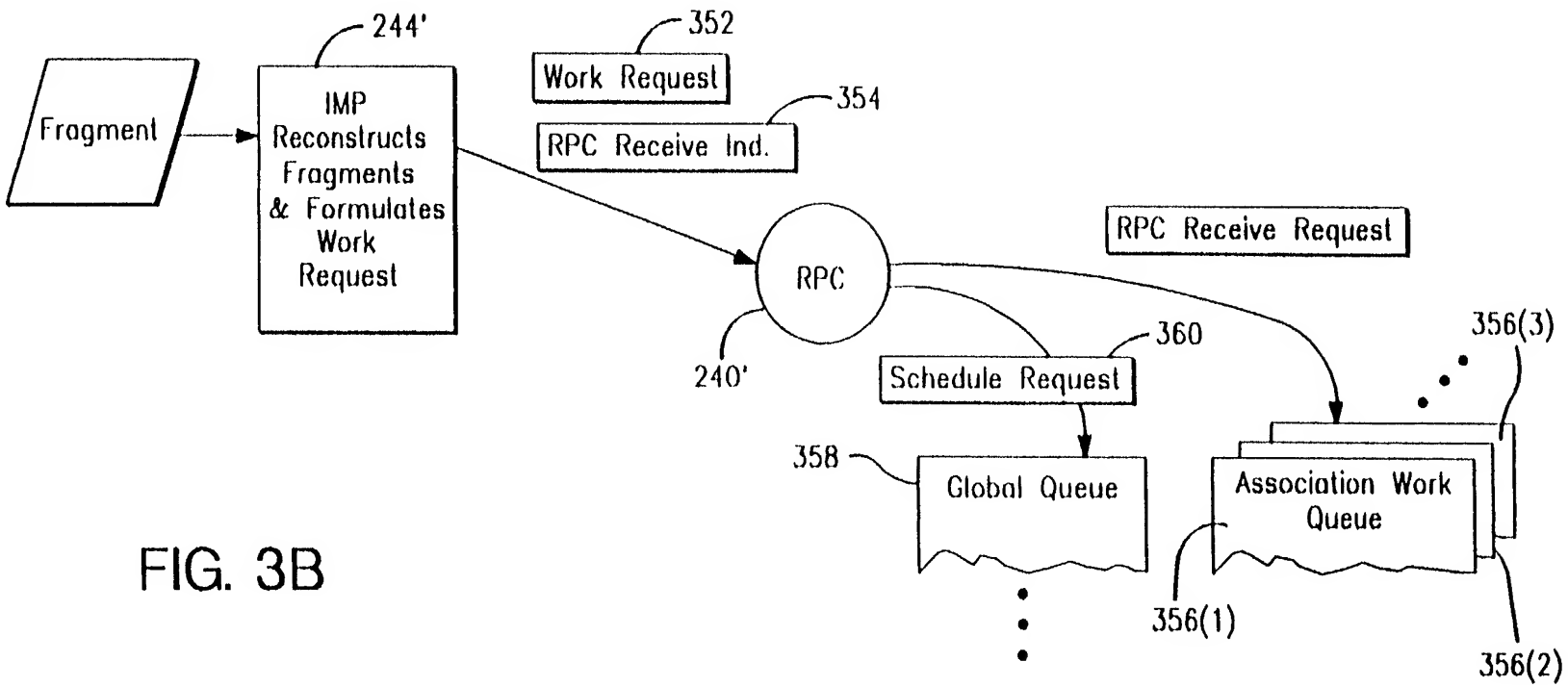

Fragment
244'
IMP
Reconstructs
Fragments
& Formulates
Work
Request
352
Work Request
354
RPC Receive Ind.
RPC
240'
RPC Receive Request
360
Schedule Request
358
Global Queue
Association Work
Queue
356(3)
356(1)
356(2)

FIG. 3B

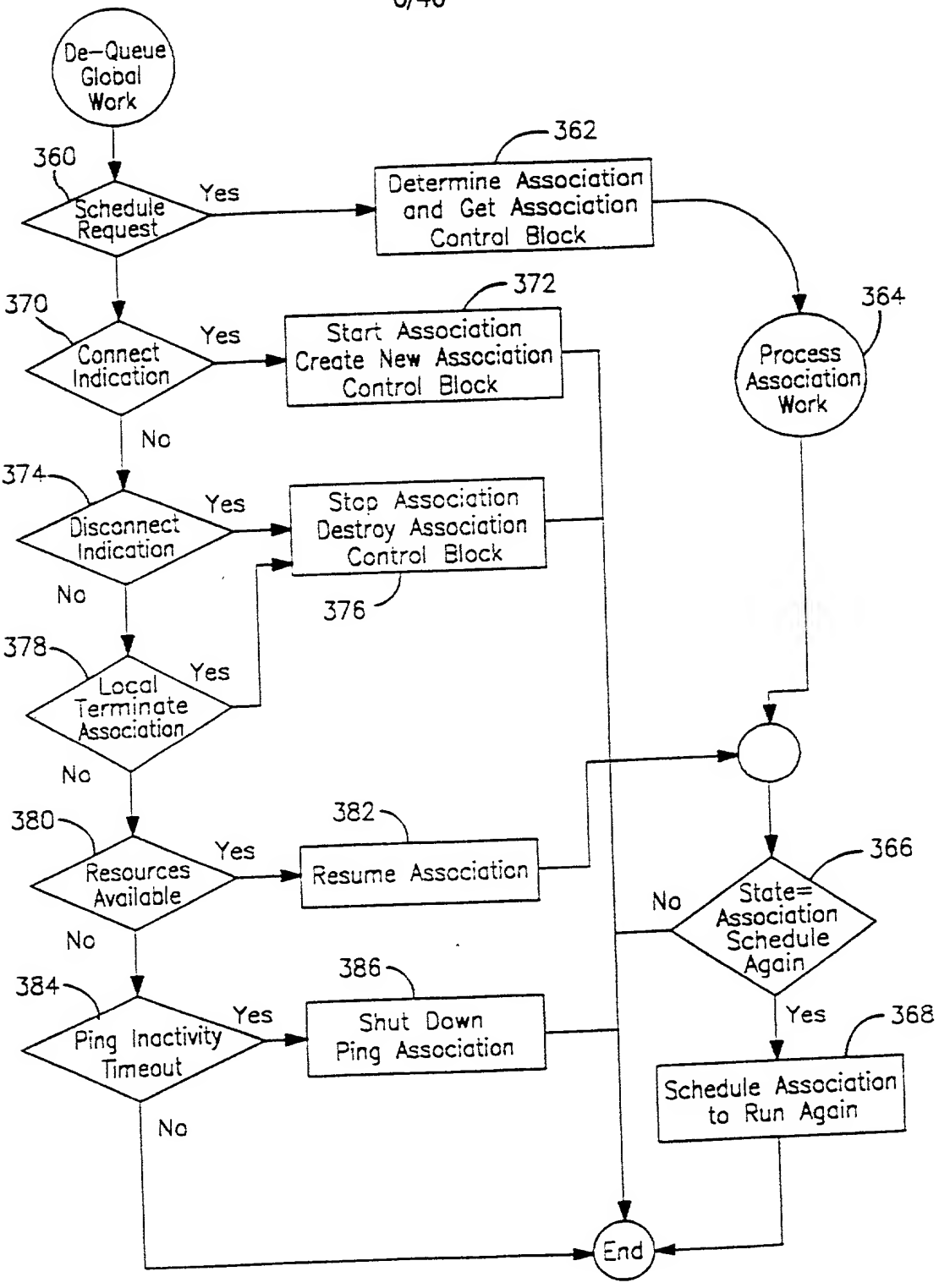

De-Queue Global Work
360
Schedule Request
Yes
362
Determine Association and Get Association Control Block
364
Process Association Work
370
Connect Indication
Yes
372
Start Association Create New Association Control Block
No
374
Disconnect Indication
Yes
Stop Association Destroy Association Control Block
376
No
378
Local Terminate Association
Yes
No
380
Resources Available
Yes
382
Resume Association
366
No
State= Association Schedule Again
No
384
Ping Inactivity Timeout
Yes
386
Shut Down Ping Association
Yes
368
Schedule Association to Run Again
No
End

FIG. 4

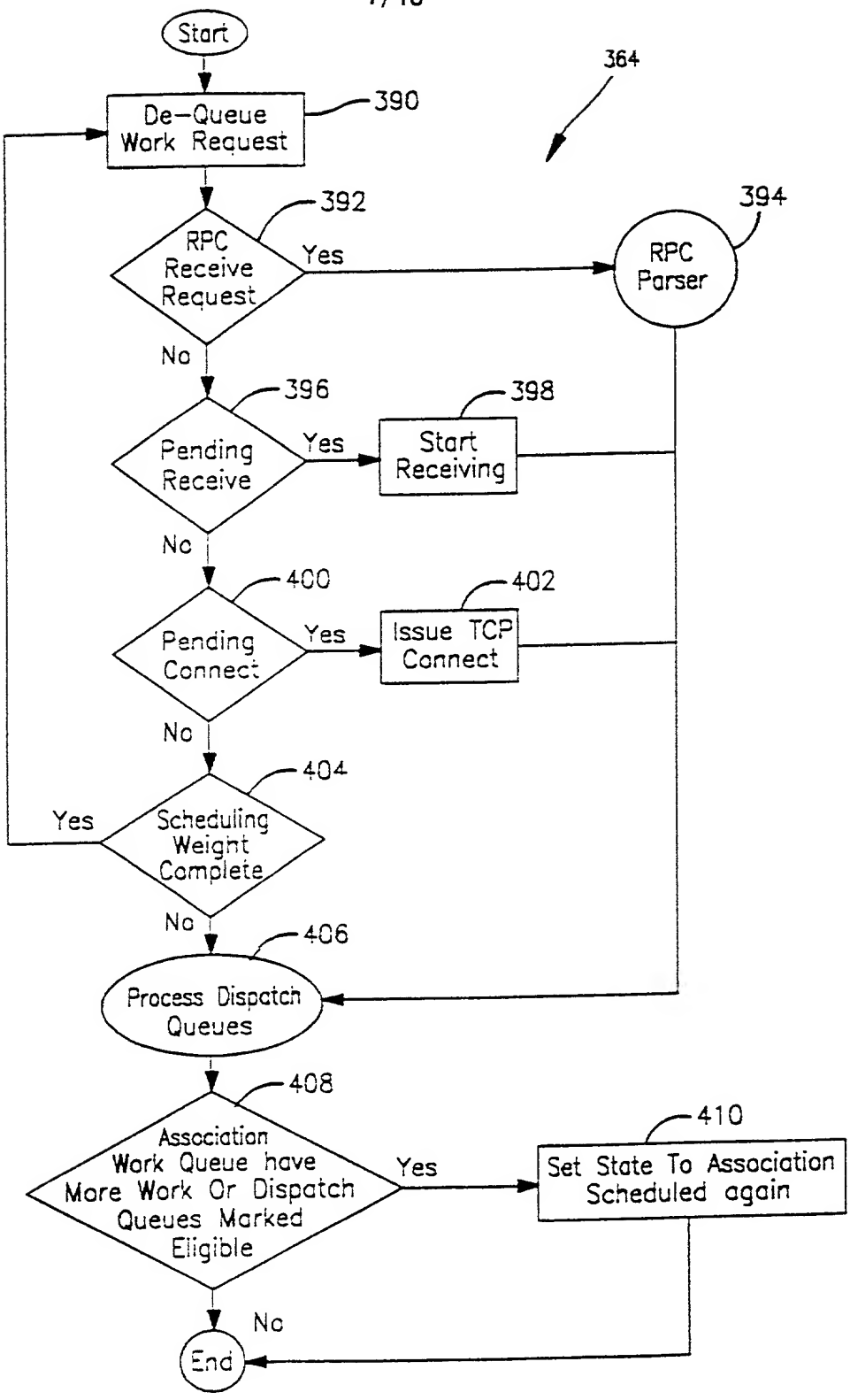


FIG. 5 Process Association Work

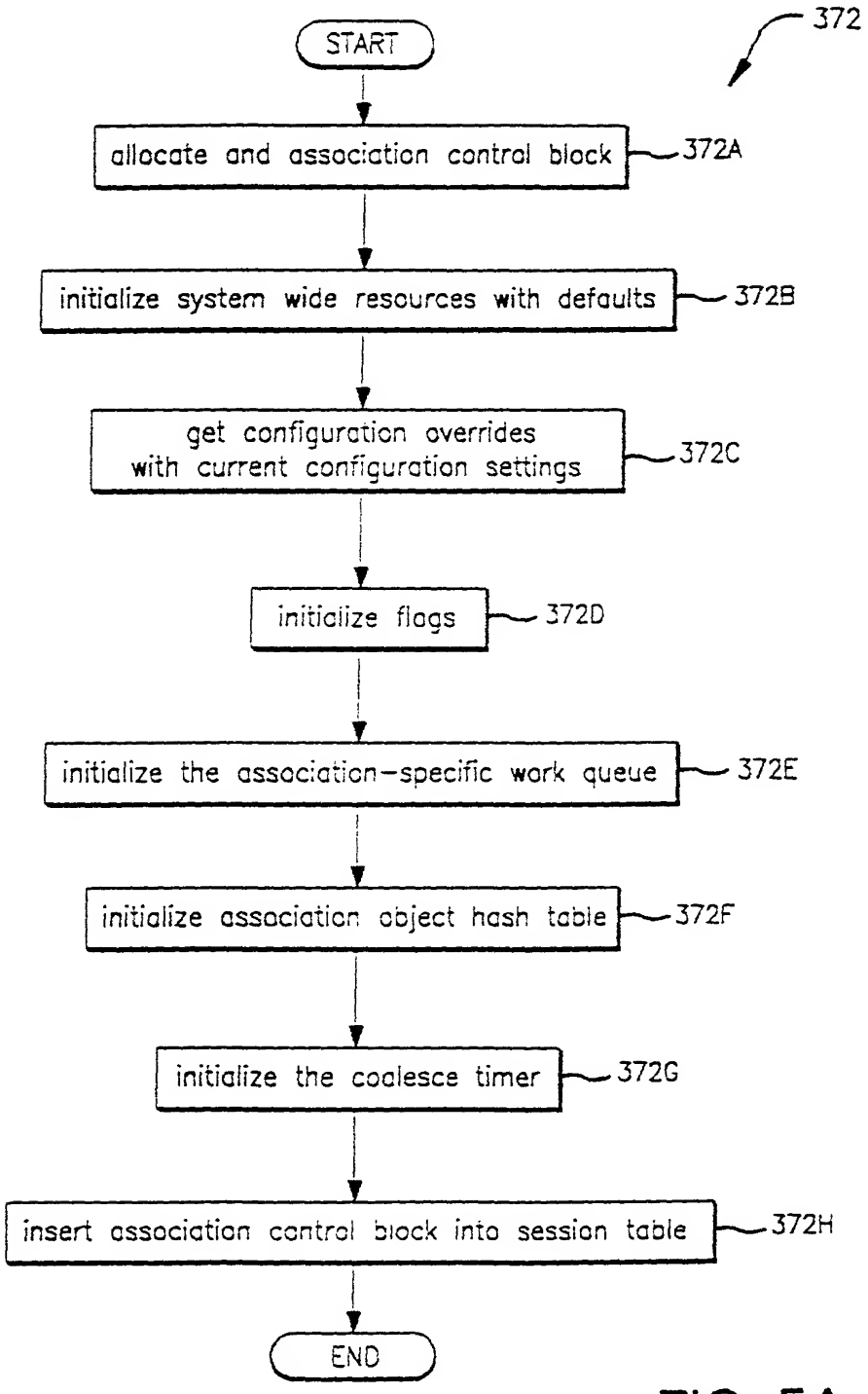

372
START
allocate and association control block
372A
initialize system wide resources with defaults
372B
get configuration overrides with current configuration settings
372C
initialize flags
372D
initialize the association-specific work queue
372E
initialize association object hash table
372F
initialize the coalesce timer
372G
insert association control block into session table
372H
END

FIG. 5A

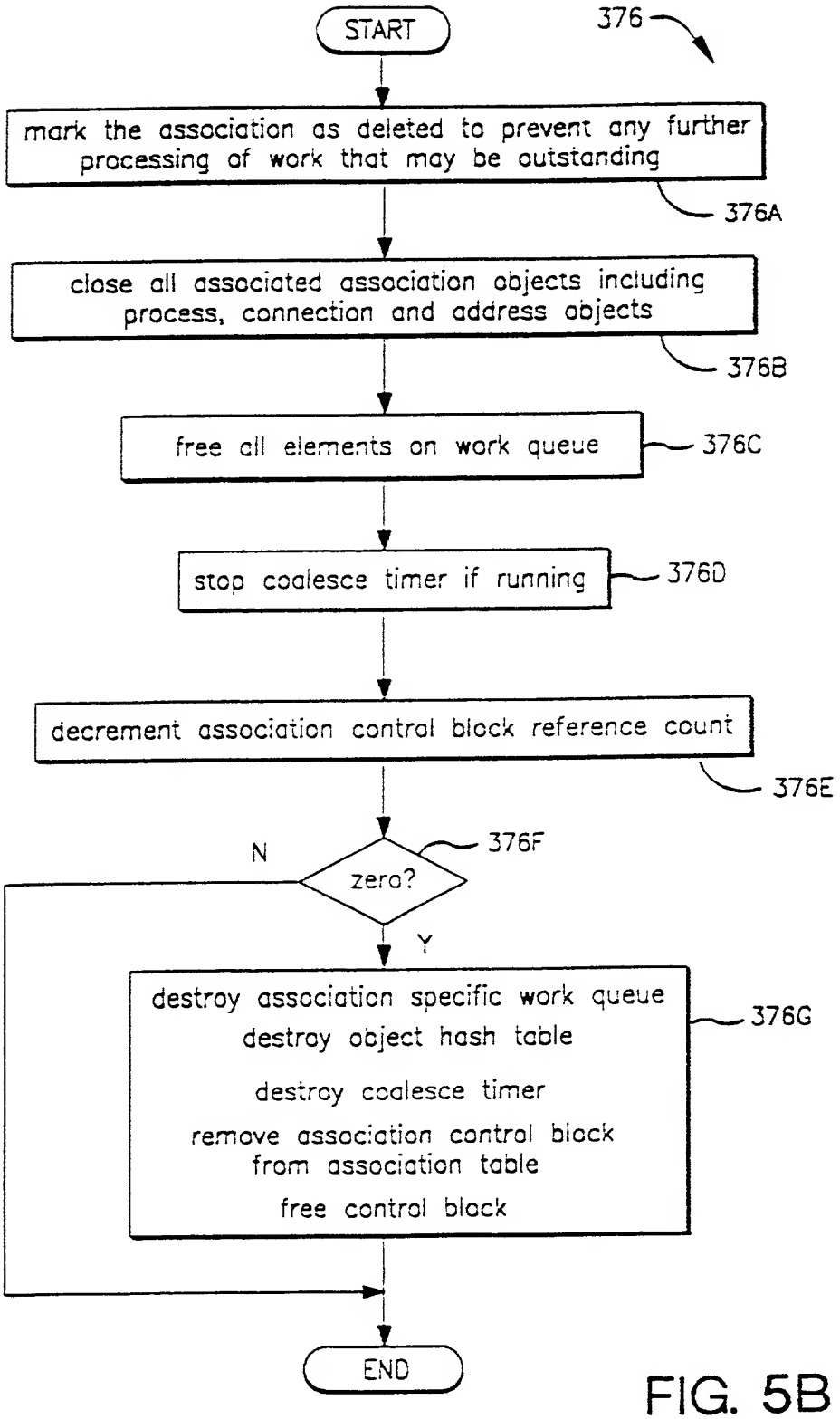

START
376
mark the association as deleted to prevent any further processing of work that may be outstanding
376A
close all associated association objects including process, connection and address objects
376B
free all elements on work queue
376C
stop coalesce timer if running
376D
decrement association control block reference count
376E
N
zero?
376F
Y
destroy association specific work queue
destroy object hash table
destroy coalesce timer
remove association control block from association table
free control block
376G
END

FIG. 5B

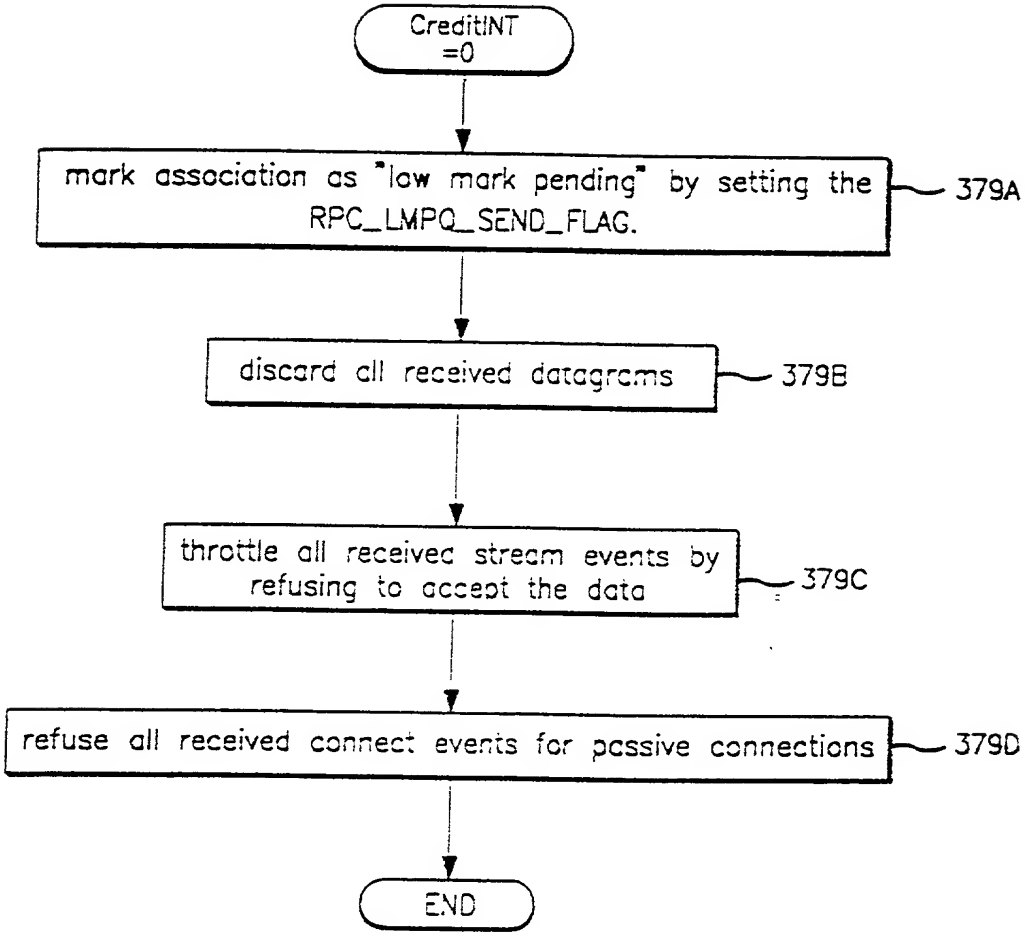

CreditINT =0
mark association as "low mark pending" by setting the RPC_LMPQ_SEND_FLAG.
379A
discard all received datagrams
379B
throttle all receivec stream events by refusing to accept the data
379C
refuse all received connect events for passive connections
379D
END

FIG. 5C

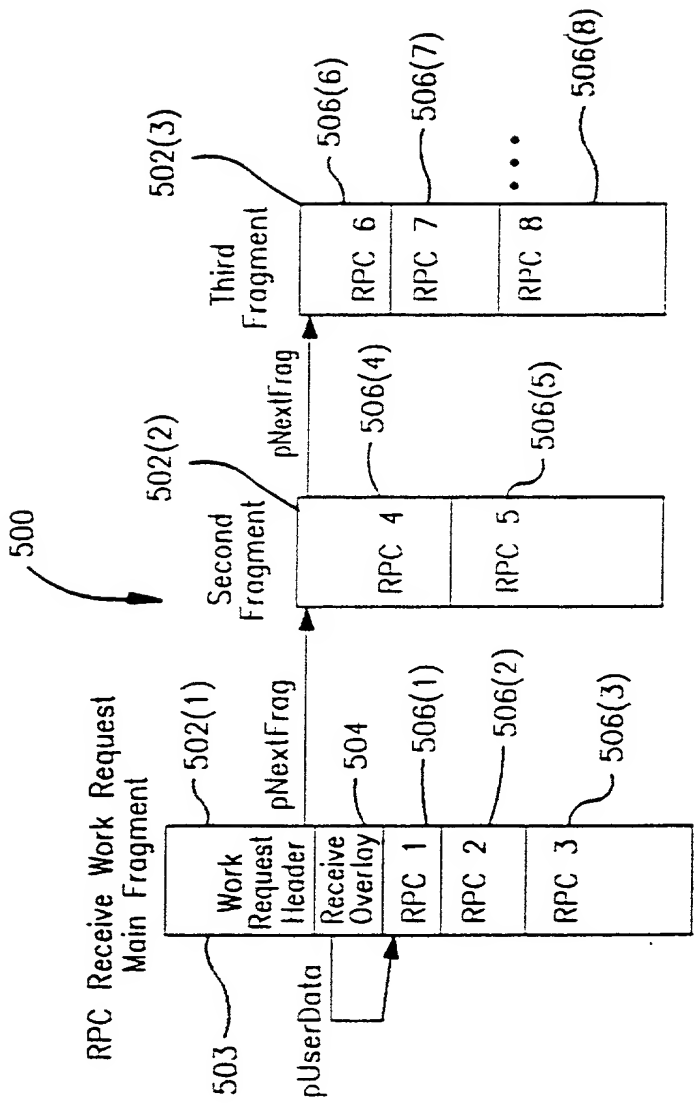

500
RPC Receive Work Request Main Fragment
503
pUserData
Work Request Header
502(1)
pNextFrag
Receive Overlay
504
RPC 1
506(1)
RPC 2
506(2)
RPC 3
506(3)
Second Fragment
502(2)
pNextFrag
RPC 4
506(4)
RPC 5
506(5)
Third Fragment
502(3)
RPC 6
506(6)
RPC 7
506(7)
RPC 8
506(8)

FIG. 6

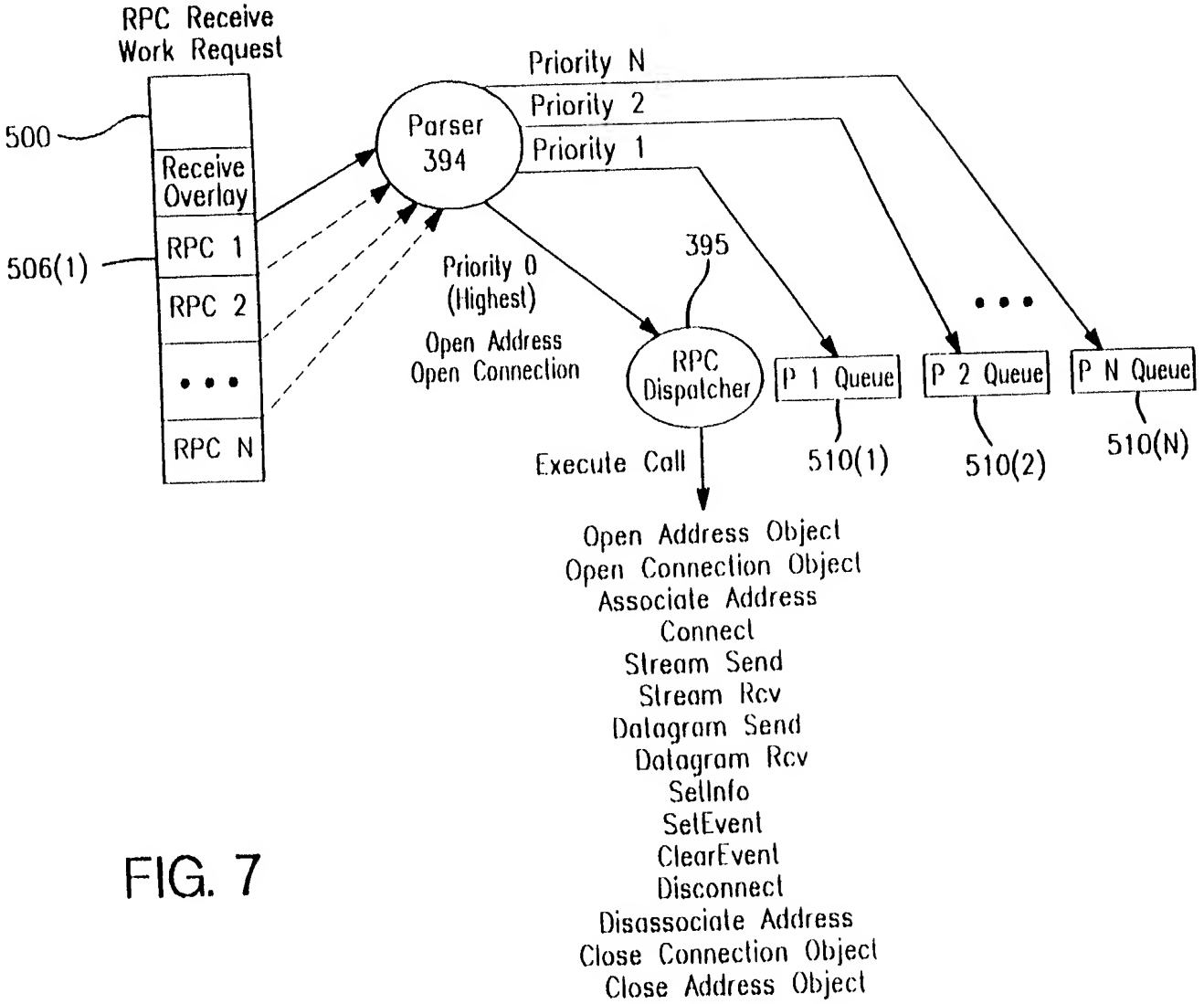

RPC Receive
Work Request
500
Receive
Overlay
RPC 1
506(1)
RPC 2
• • •
RPC N
Parser
394
Priority N
Priority 2
Priority 1
Priority 0
(Highest)
Open Address
Open Connection
395
RPC
Dispatcher
P 1 Queue
P 2 Queue
P N Queue
• • •
510(1)
510(2)
510(N)
Execute Call
Open Address Object
Open Connection Object
Associate Address
Connect
Stream Send
Stream Rcv
Datagram Send
Datagram Rcv
SetInfo
SetEvent
ClearEvent
Disconnect
Disassociate Address
Close Connection Object
Close Address Object

FIG. 7

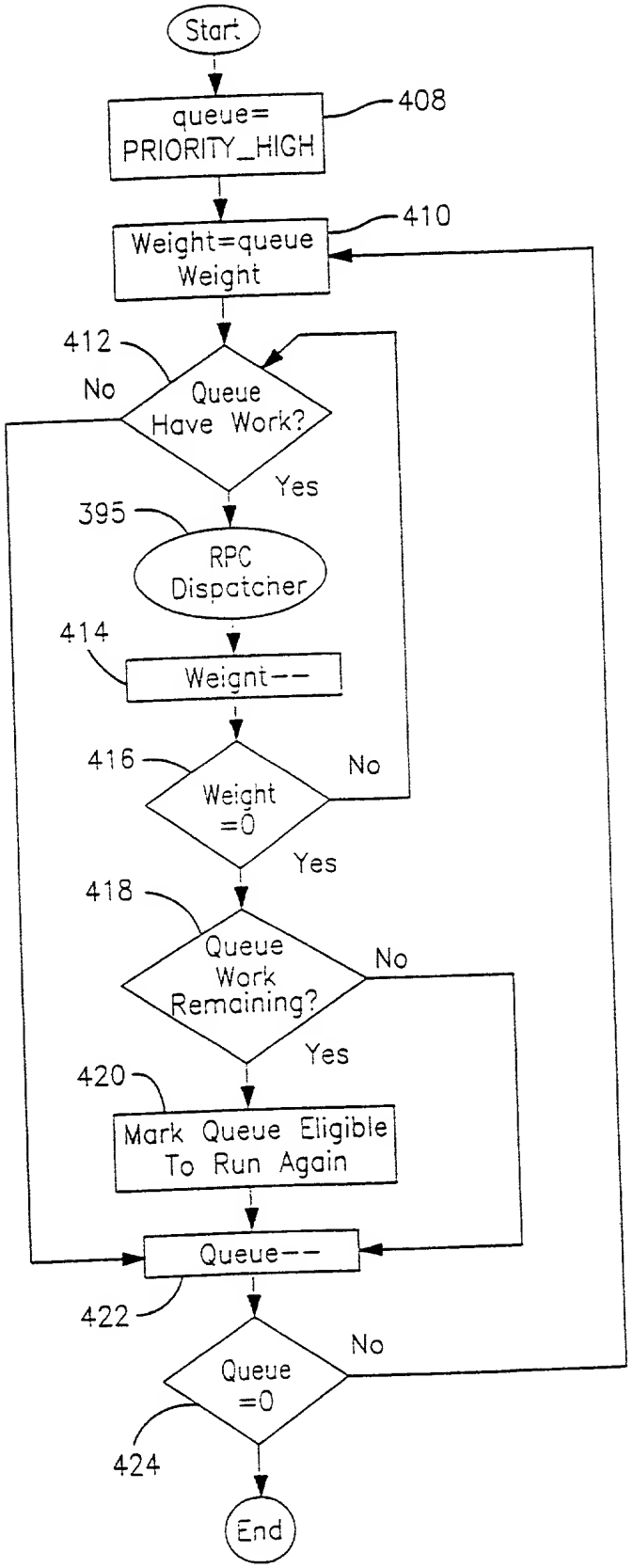


Fig. 8
Process Priority
Dispatch Queues

3868WO 2228.001

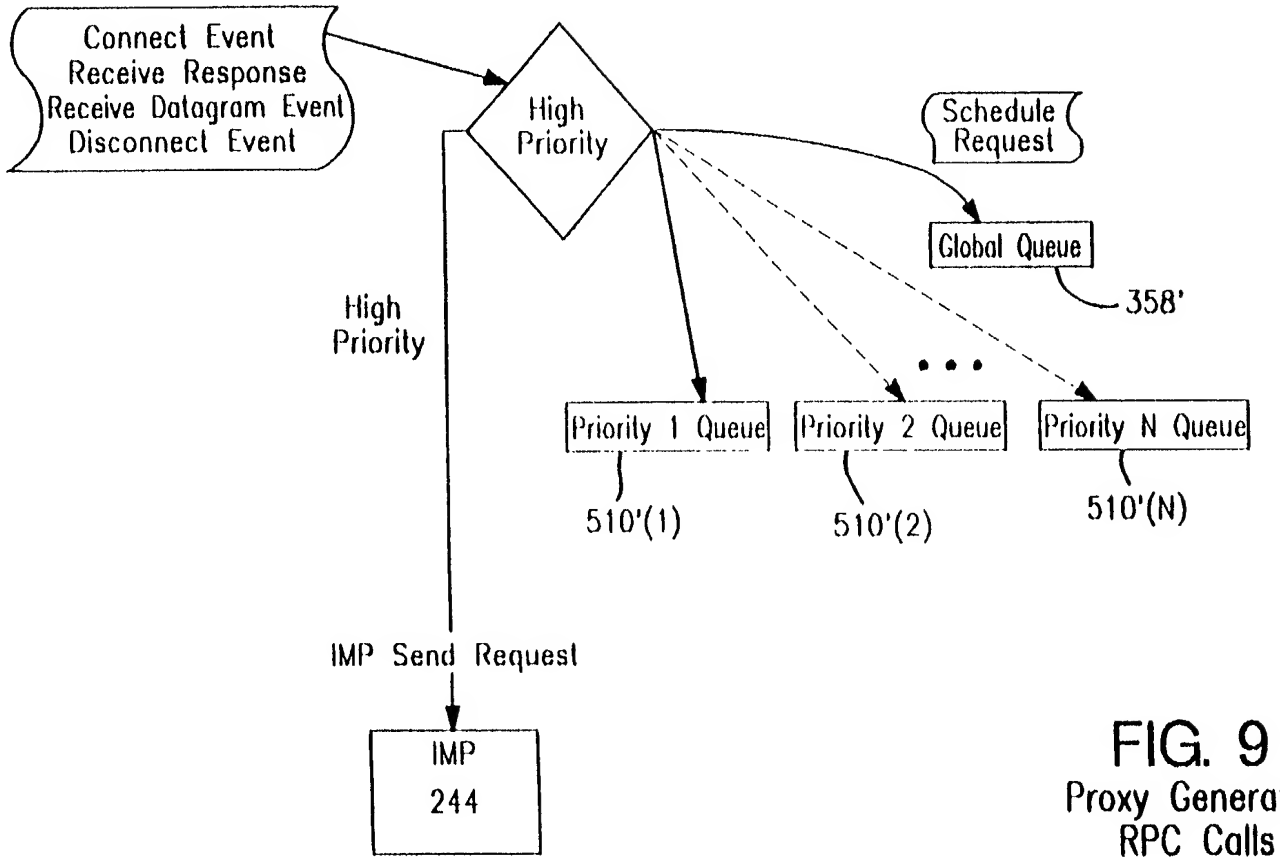
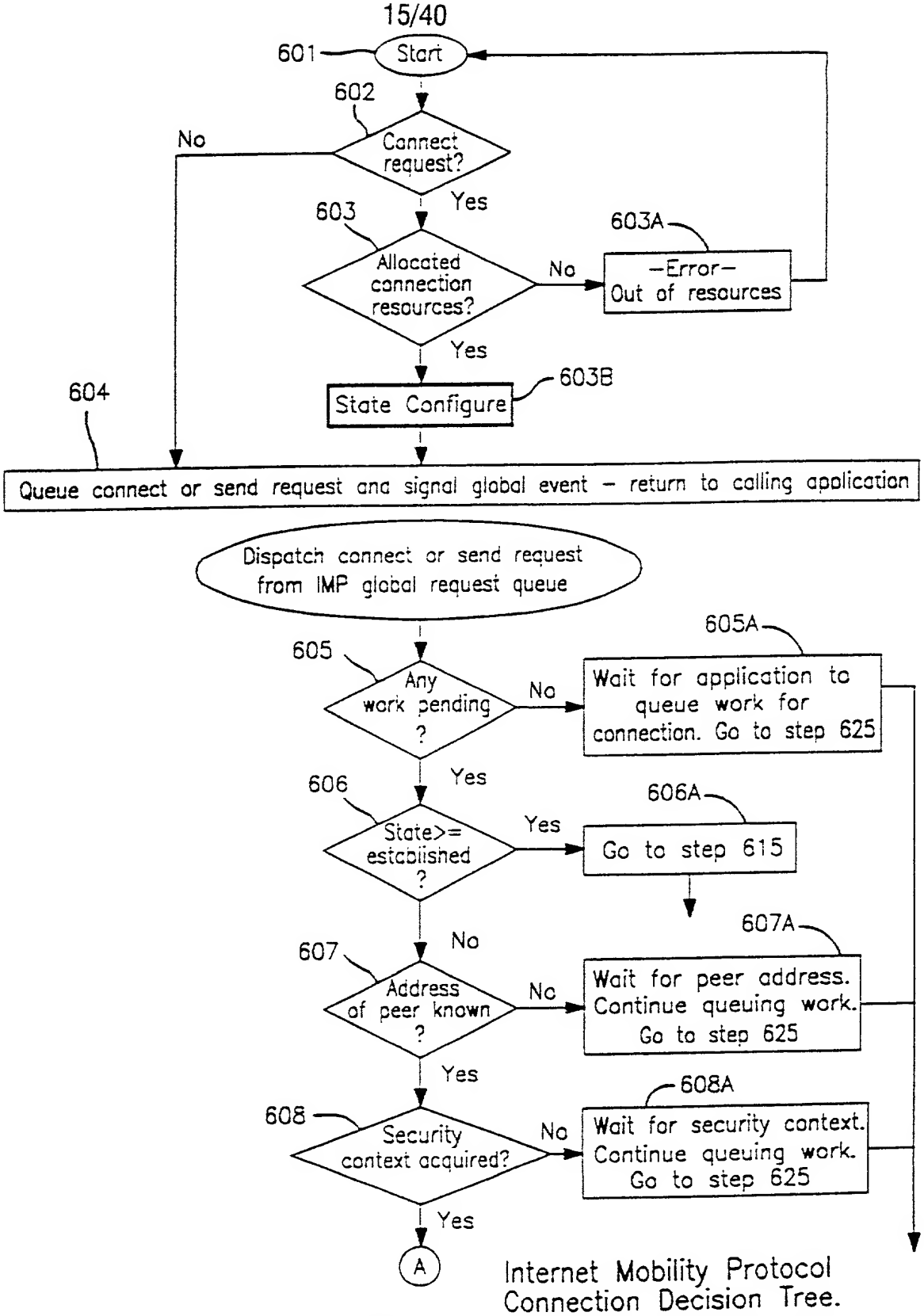


FIG. 9
Proxy Generated
RPC Calls



Internet Mobility Protocol Connection Decision Tree.

FIG. 10A Connect and Send request logic

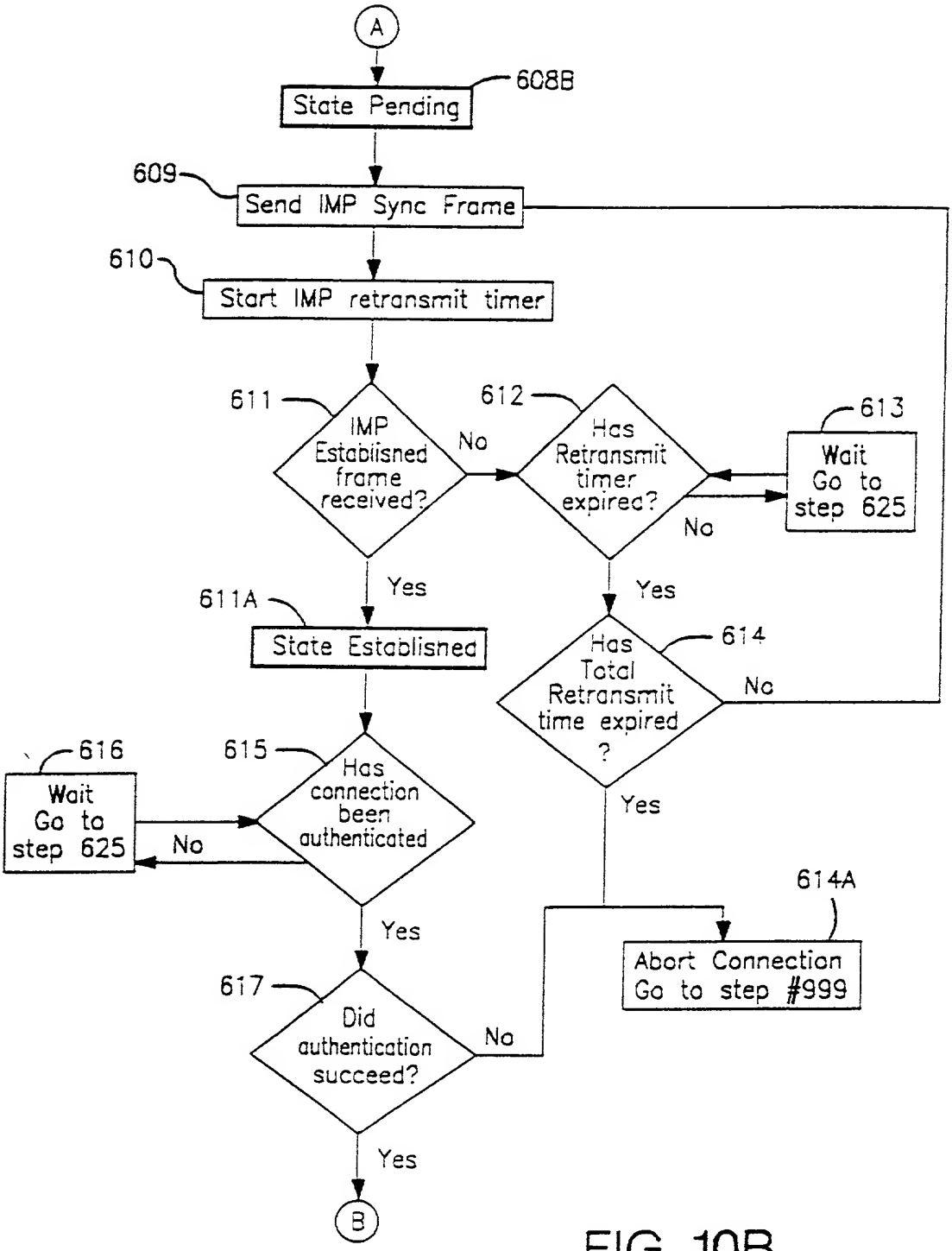

A
608B
State Pending
609
Send IMP Sync Frame
610
Start IMP retransmit timer
611
IMP Established frame received?
No
612
Has Retransmit timer expired?
613
Wait Go to step 625
No
Yes
Yes
611A
State Established
614
Has Total Retransmit time expired ?
No
Yes
616
Wait Go to step 625
615
Has connection been authenticated
No
Yes
614A
Abort Connection Go to step #999
617
Did authentication succeed?
No
Yes
B

FIG. 10B

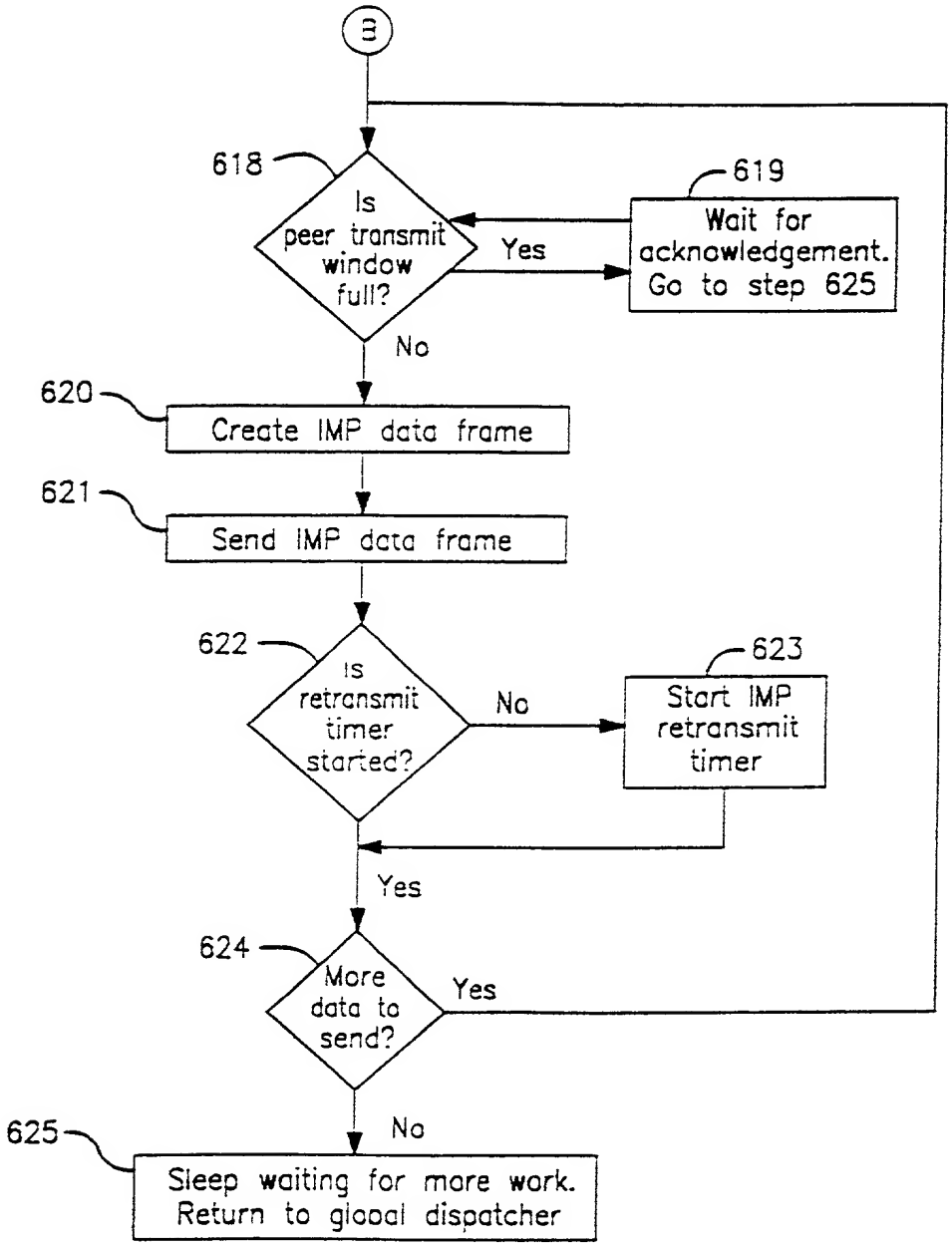

B
618
Is peer transmit window full?
Yes
619
Wait for acknowledgement. Go to step 625
No
620
Create IMP data frame
621
Send IMP data frame
622
Is retransmit timer started?
No
623
Start IMP retransmit timer
Yes
624
More data to send?
Yes
No
625
Sleep waiting for more work. Return to global dispatcher

FIG. 10C

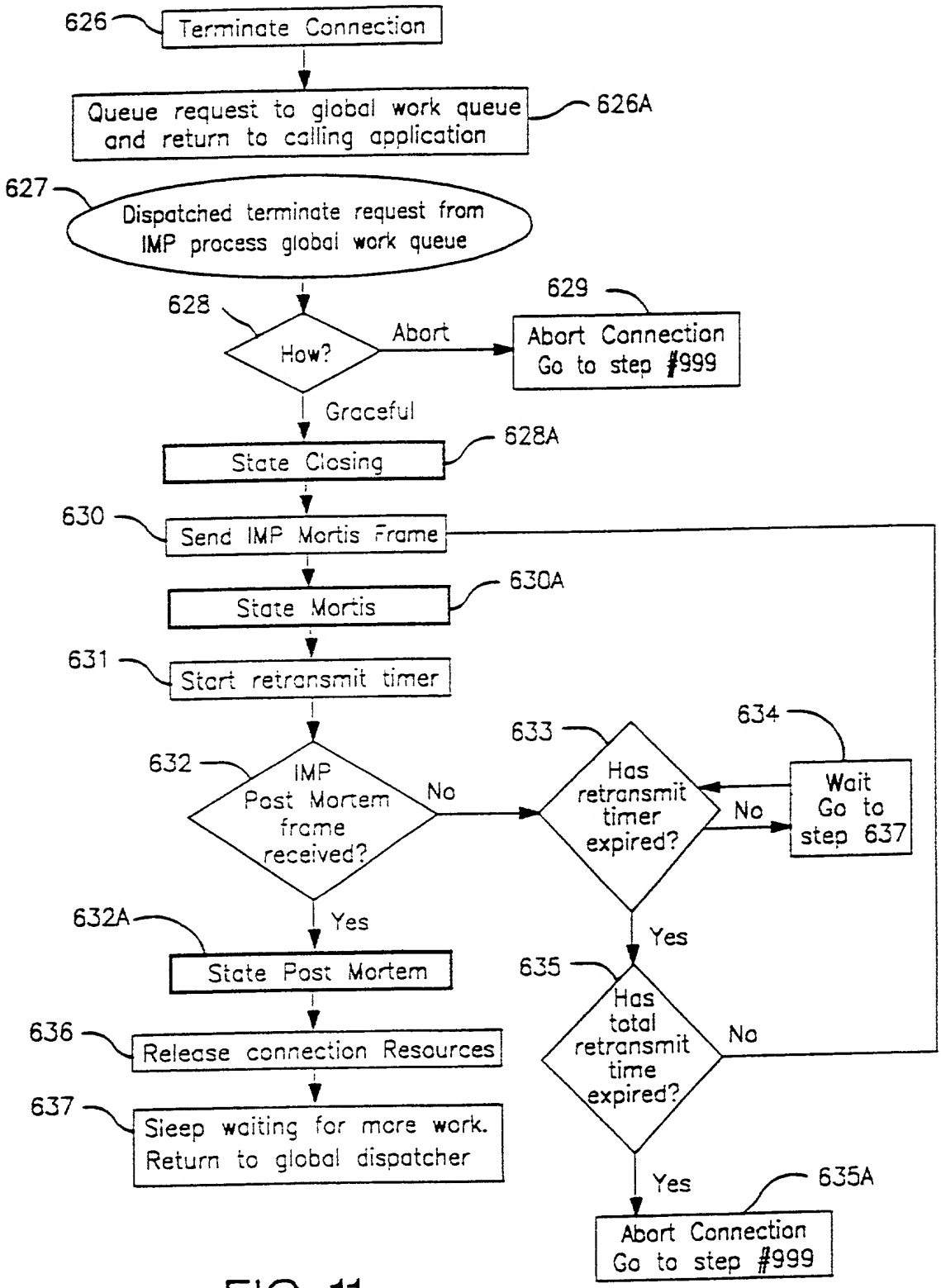


FIG. 11

Terminate Connection request logic

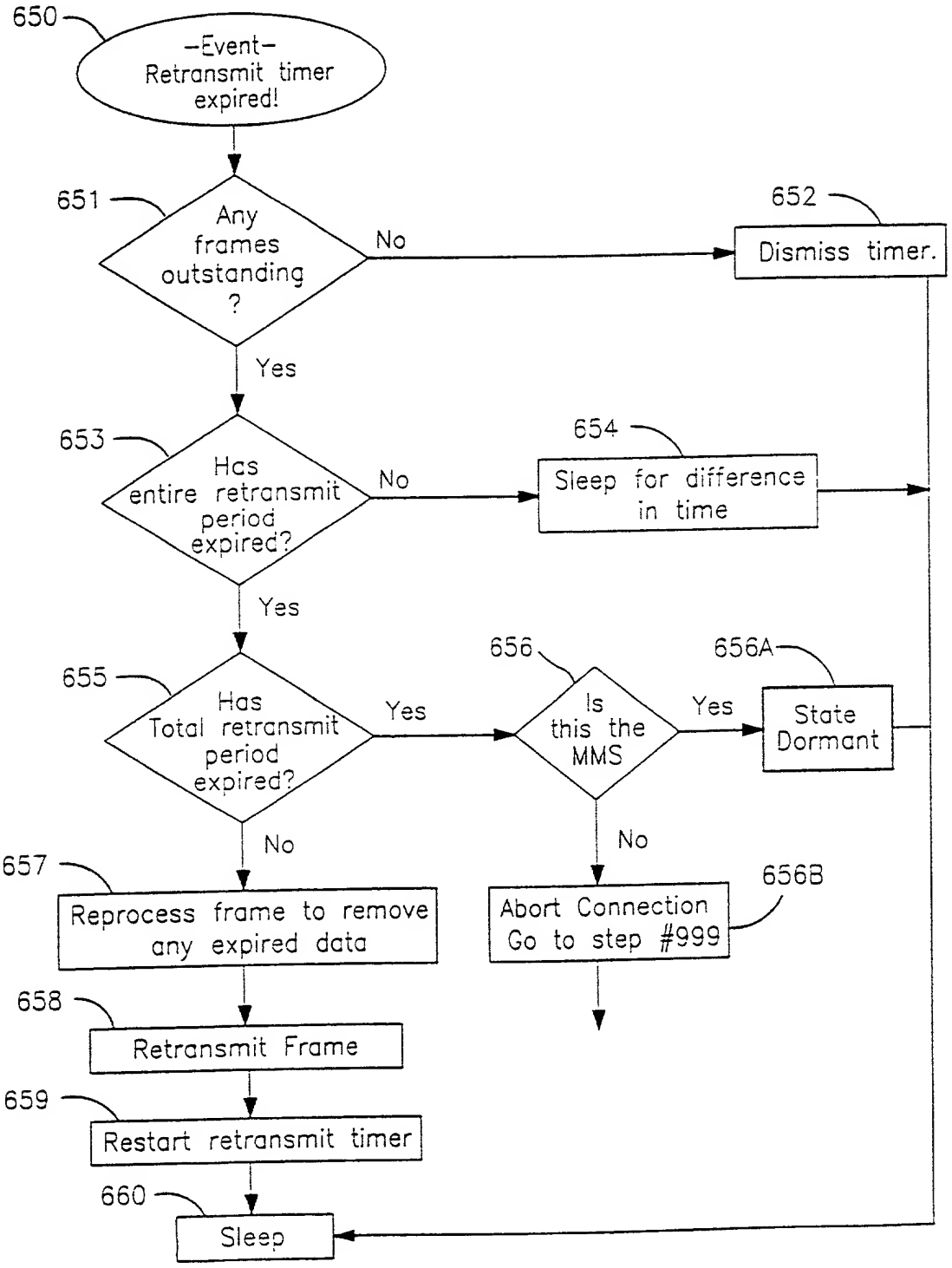


Fig. 12

Retransmit Event Logic

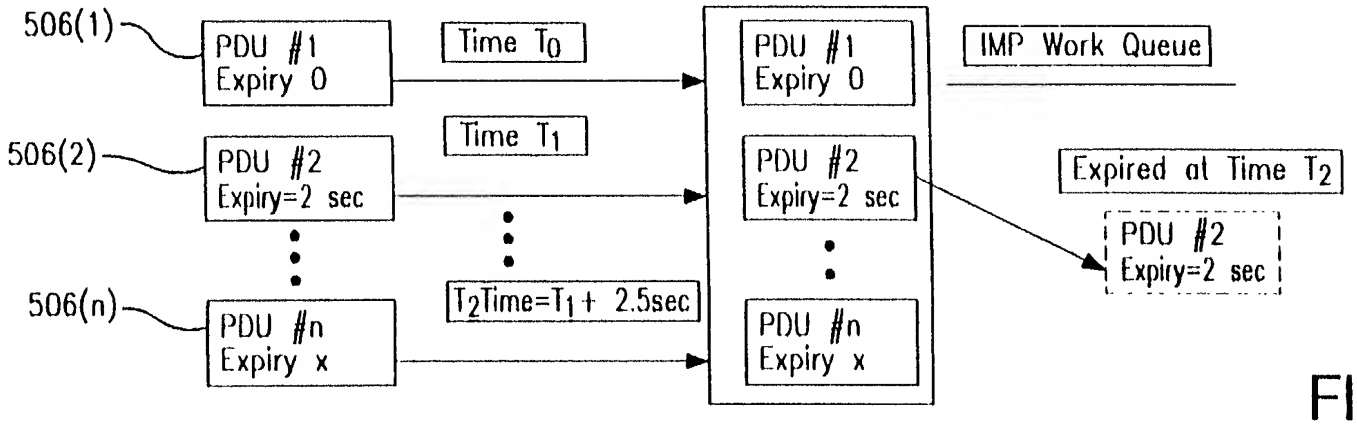


FIG. 12A

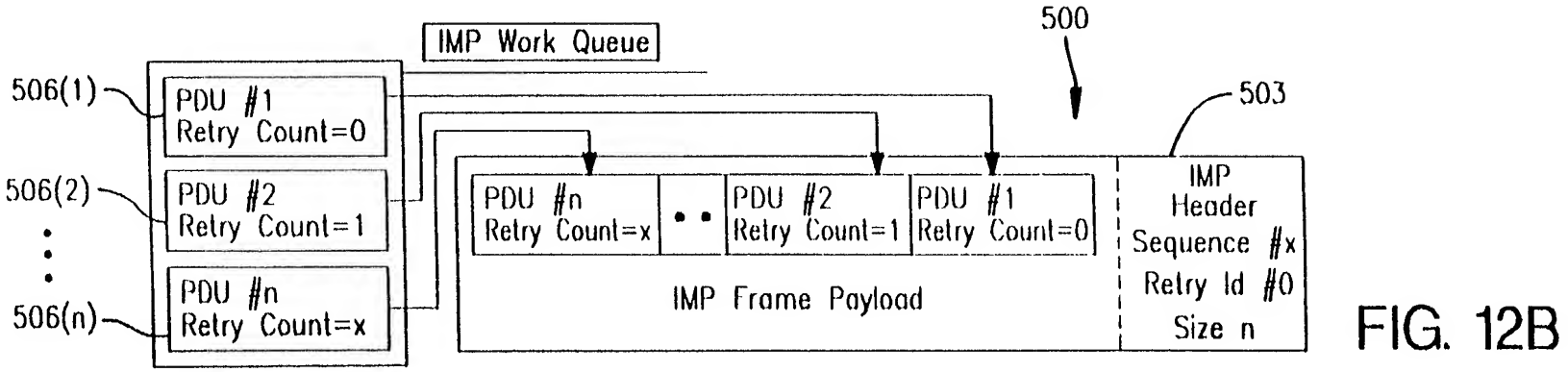


FIG. 12B

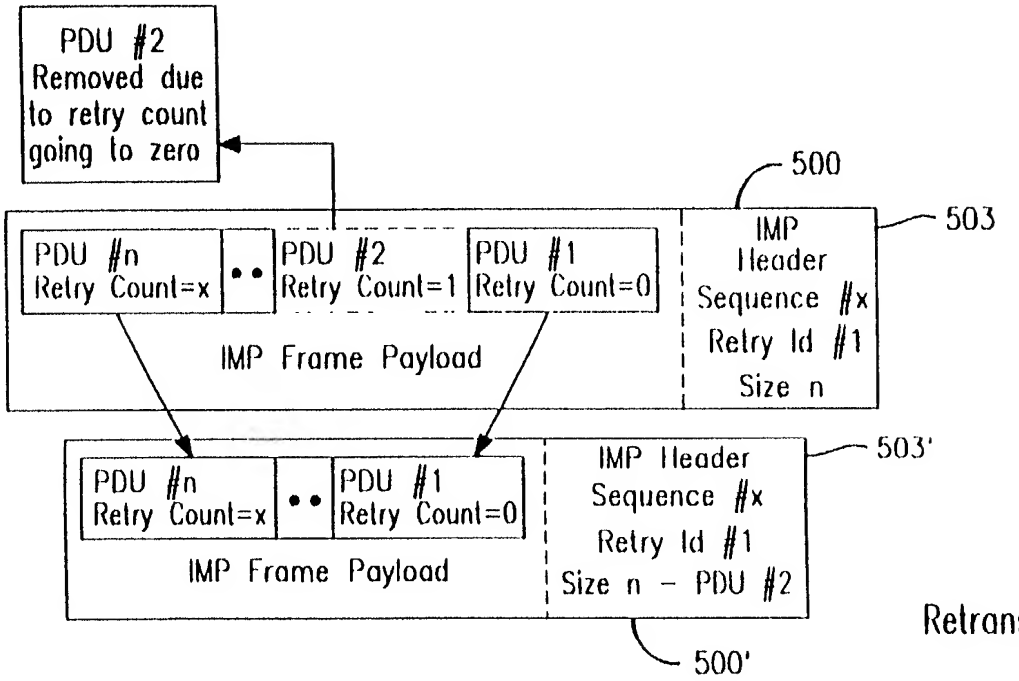


FIG. 12C

Retransmission of IMP Frame

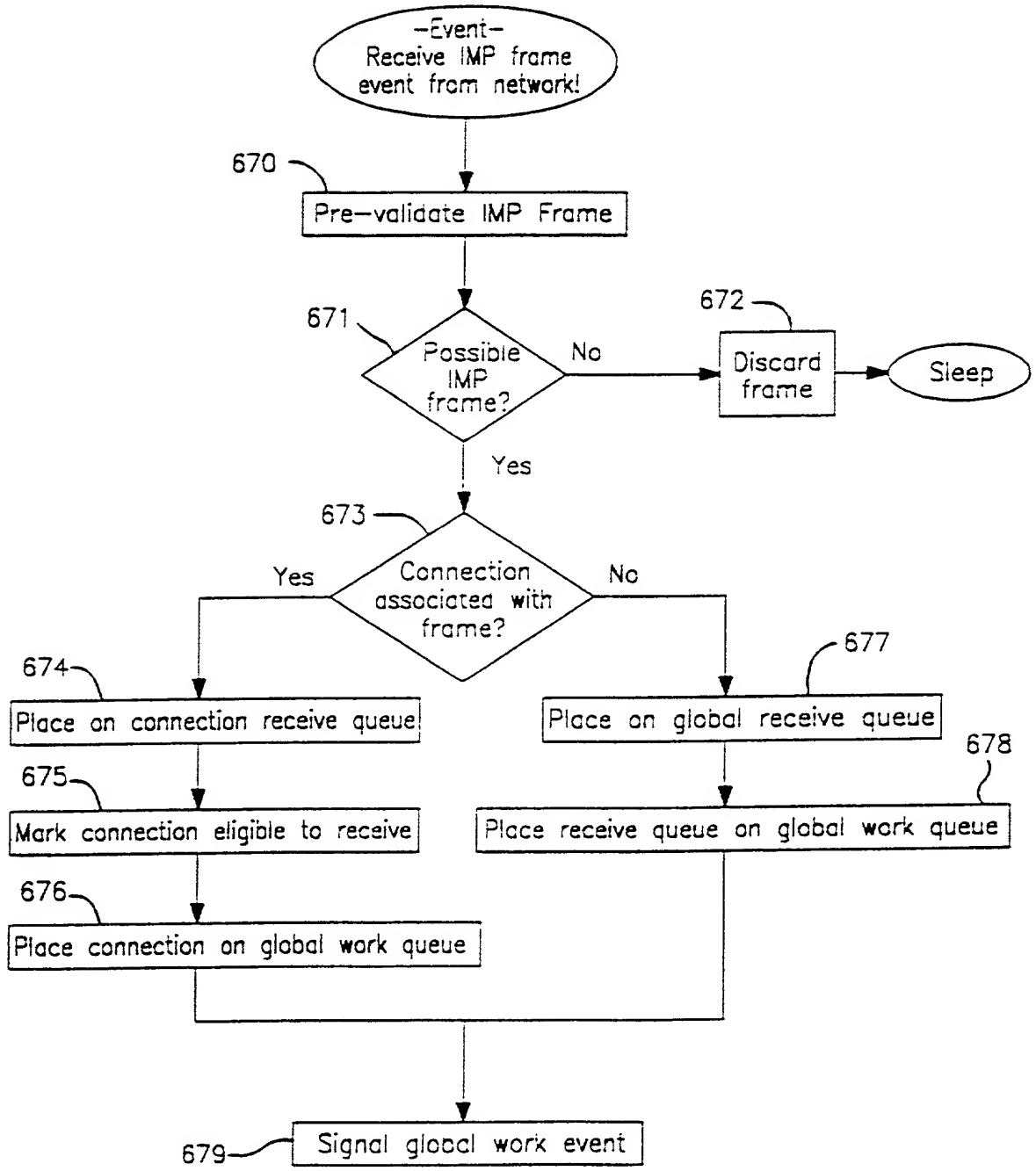


FIG. 13A
Receive Event Logic

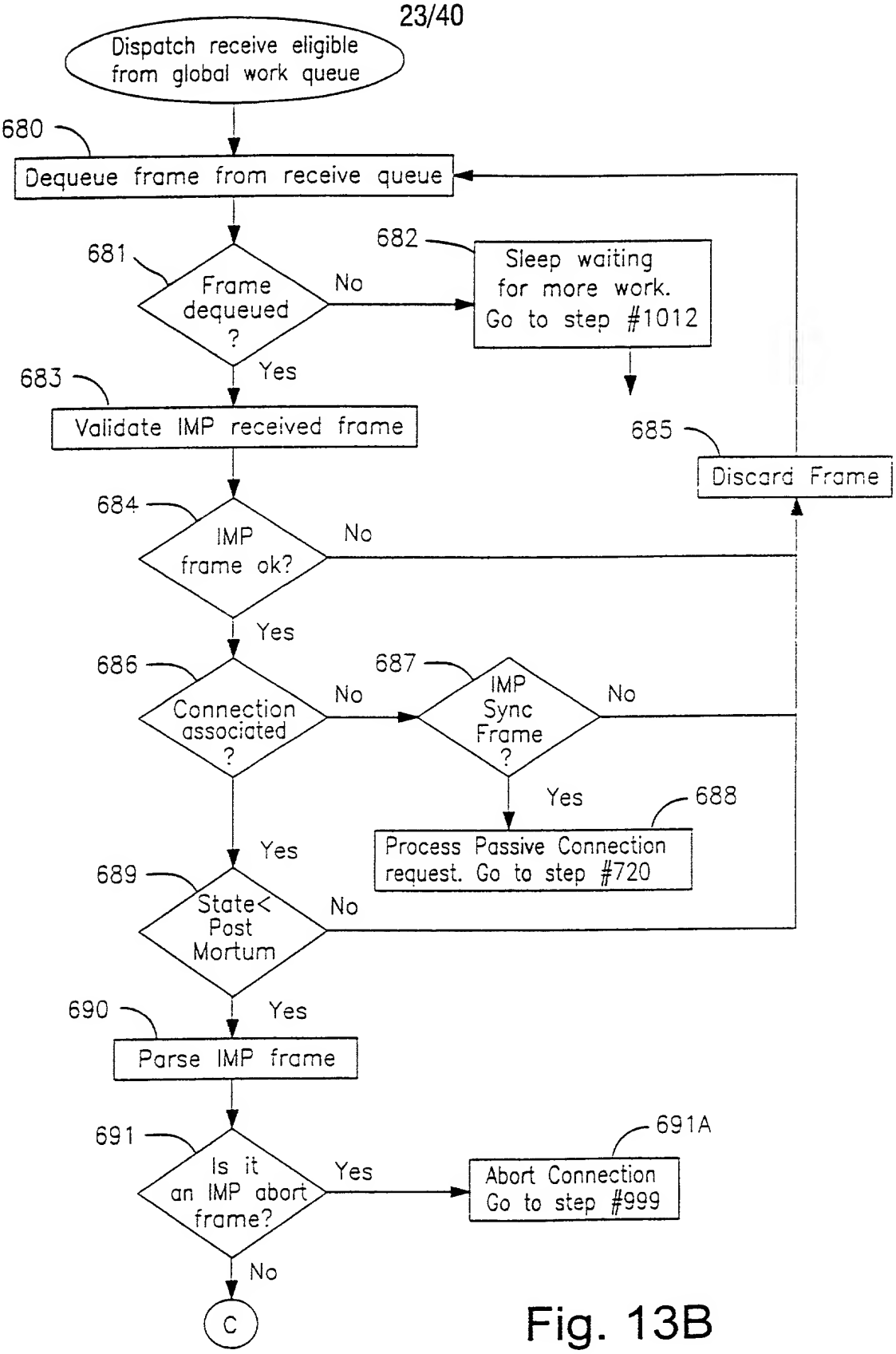

Dispatch receive eligible from global work queue
680
Dequeue frame from receive queue
681
Frame dequeued ?
No
682
Sleep waiting for more work. Go to step #1012
Yes
683
Validate IMP received frame
685
Discard Frame
684
IMP frame ok?
No
Yes
686
Connection associated ?
No
687
IMP Sync Frame ?
No
Yes
688
Process Passive Connection request. Go to step #720
Yes
689
State< Post Mortum
No
690
Yes
Parse IMP frame
691
Is it an IMP abort frame?
Yes
691A
Abort Connection Go to step #999
No
C

Fig. 13B

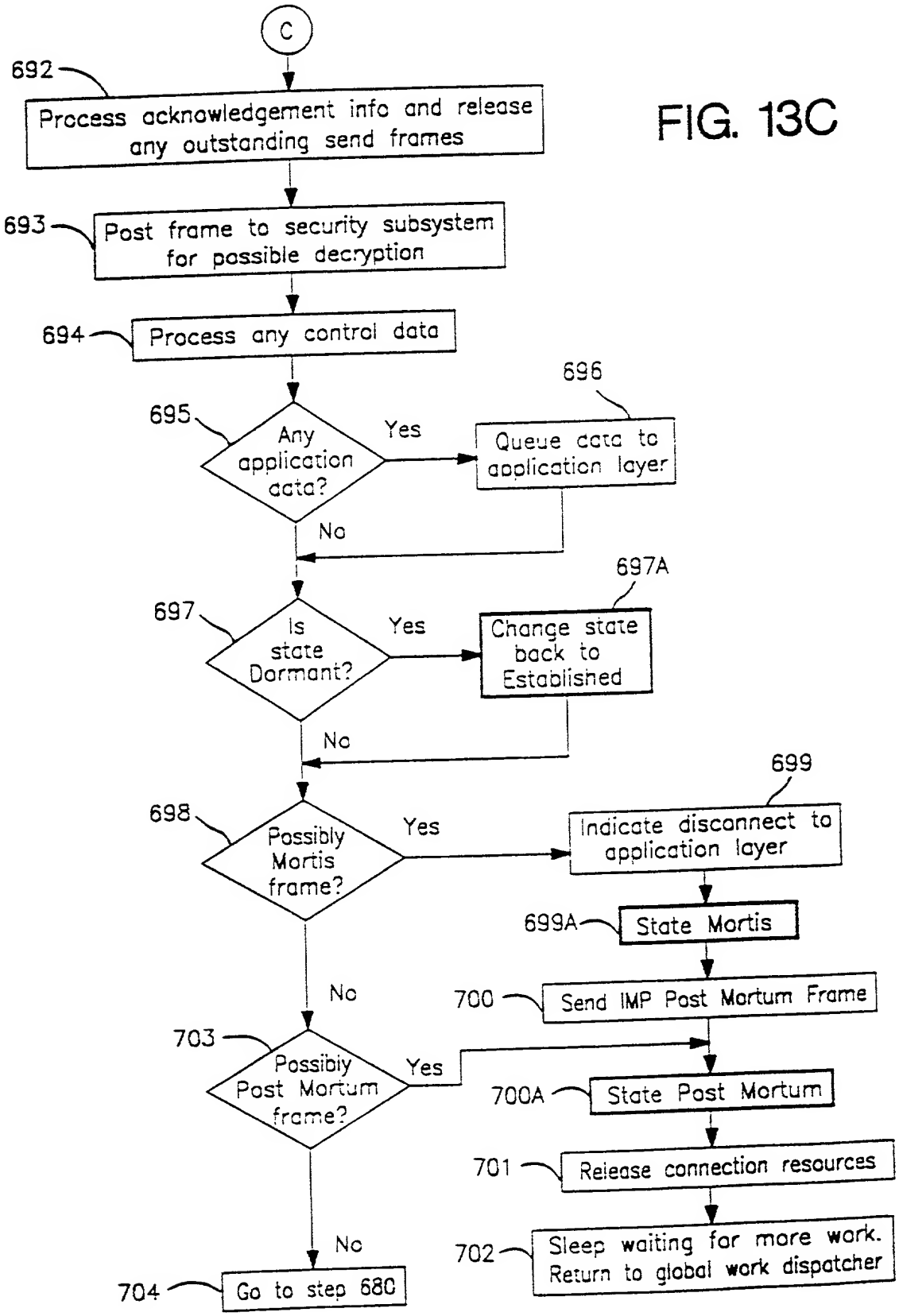

C
692
Process acknowledgement info and release any outstanding send frames
693
Post frame to security subsystem for possible decryption
694
Process any control data
695
Any application data?
Yes
696
Queue data to application layer
No
697
Is state Dormant?
Yes
697A
Change state back to Established
No
698
Possibly Mortis frame?
Yes
699
Indicate disconnect to application layer
699A
State Mortis
No
700
Send IMP Post Mortum Frame
703
Possibly Post Mortum frame?
Yes
700A
State Post Mortum
701
Release connection resources
No
702
Sleep waiting for more work. Return to global work dispatcher
704
Go to step 680

FIG. 13C

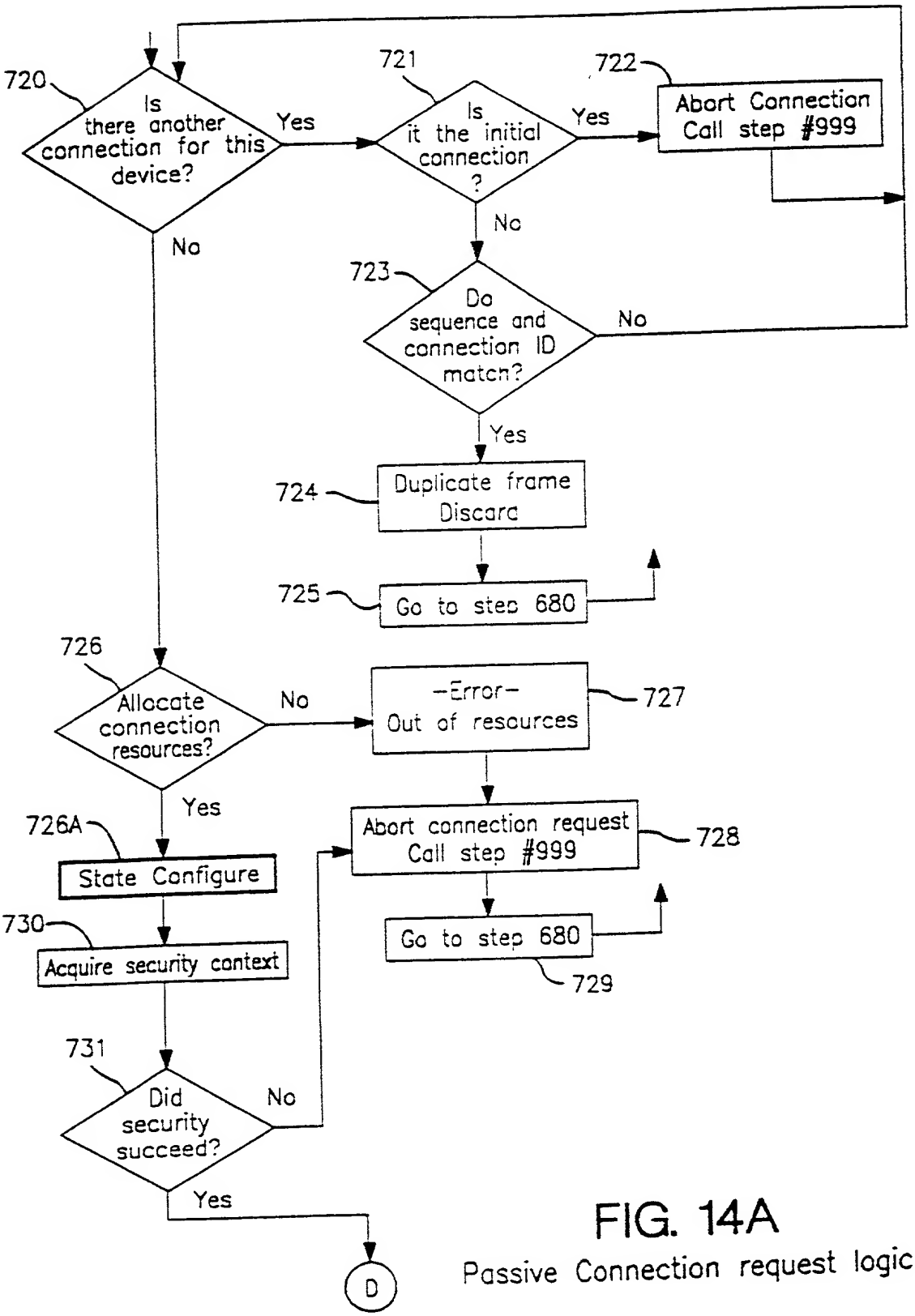


FIG. 14A

Passive Connection request logic

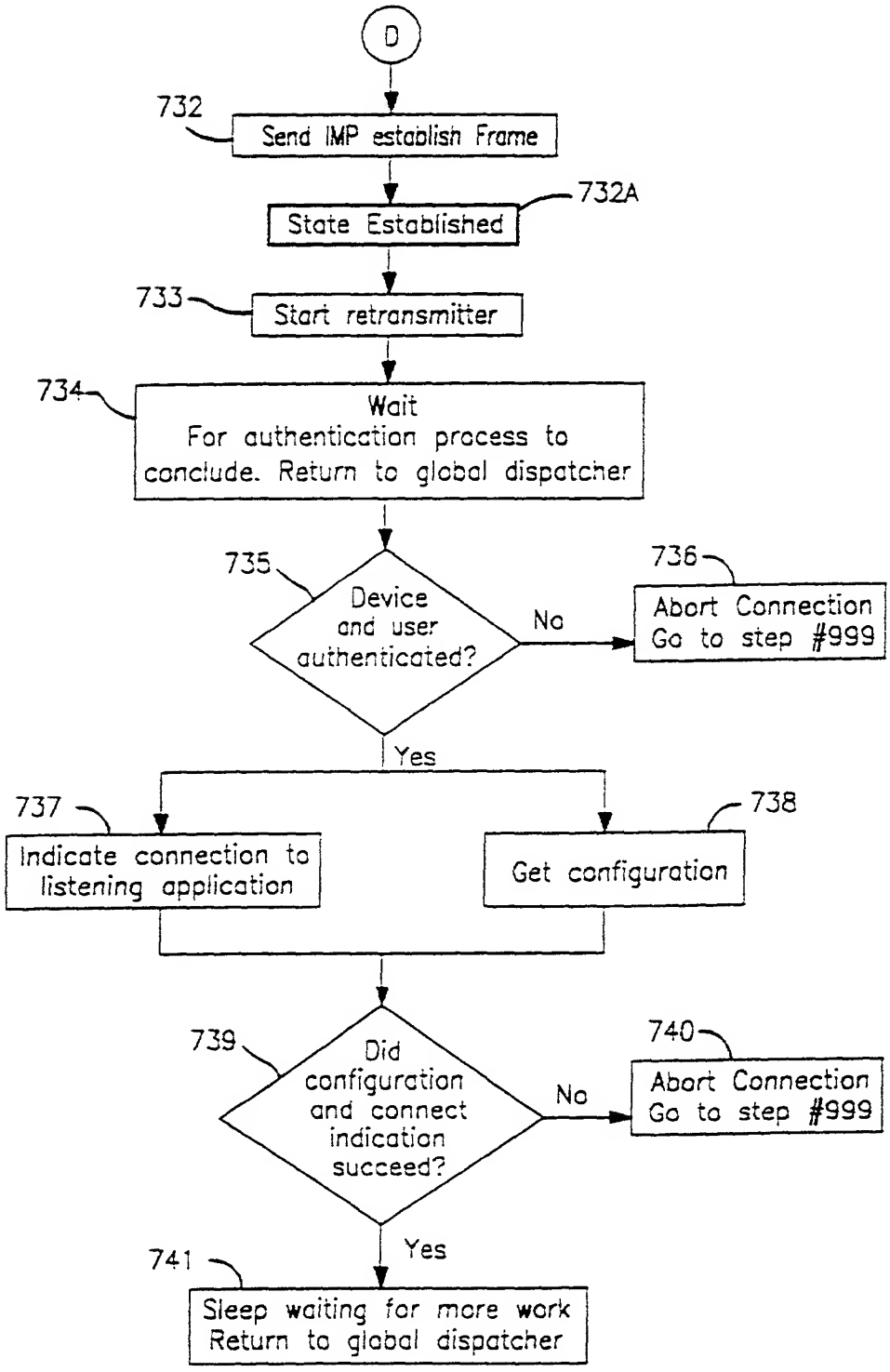

D
732
Send IMP establish Frame
732A
State Established
733
Start retransmitter
734
Wait
For authentication process to conclude. Return to global dispatcher
735
Device and user authenticated?
No
736
Abort Connection
Go to step #999
Yes
737
Indicate connection to listening application
738
Get configuration
739
Did configuration and connect indication succeed?
No
740
Abort Connection
Go to step #999
Yes
741
Sleep waiting for more work
Return to global dispatcher

FIG. 14B

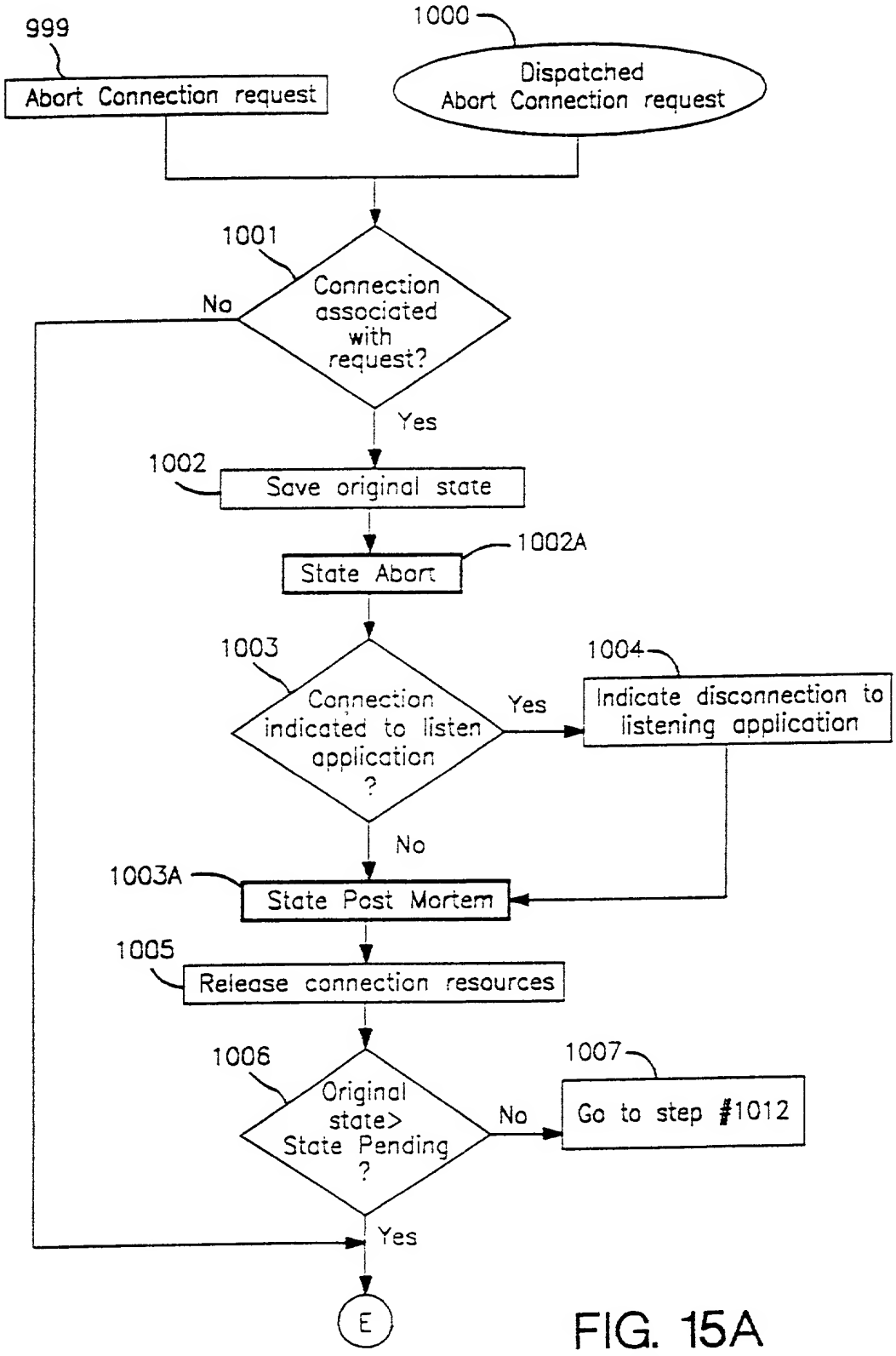


FIG. 15A

Abort Connection request logic

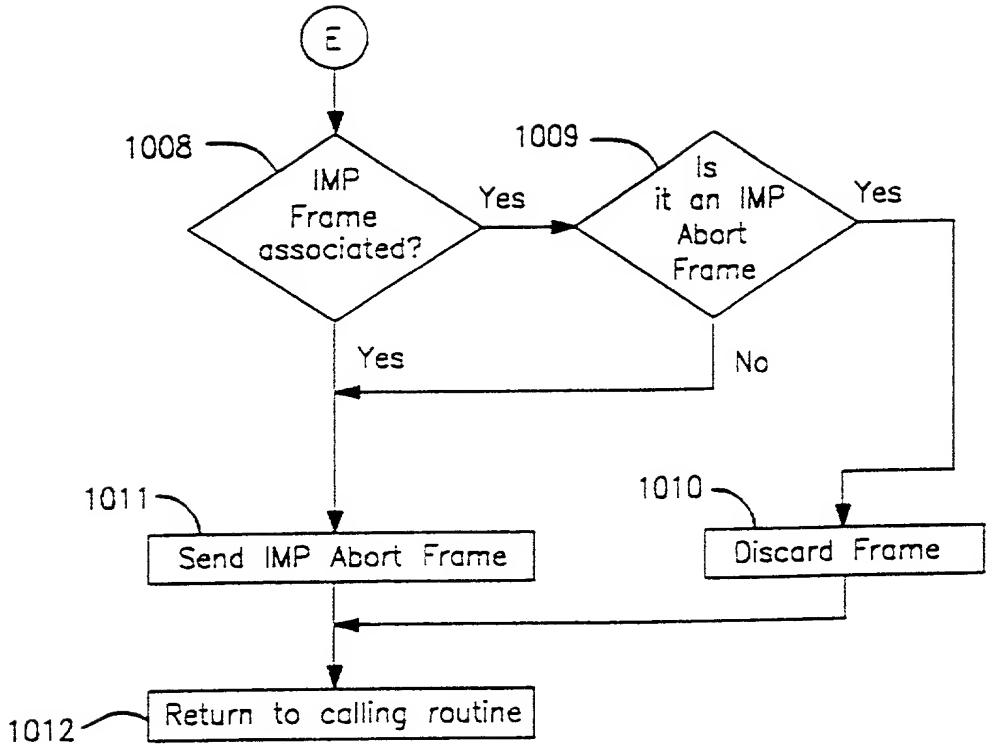

E
1008
IMP Frame associated?
Yes
1009
Is it an IMP Abort Frame
Yes
Yes
No
1011
Send IMP Abort Frame
1010
Discard Frame
1012
Return to calling routine

FIG. 15B

WO 98/03922 PCT/US97/12607

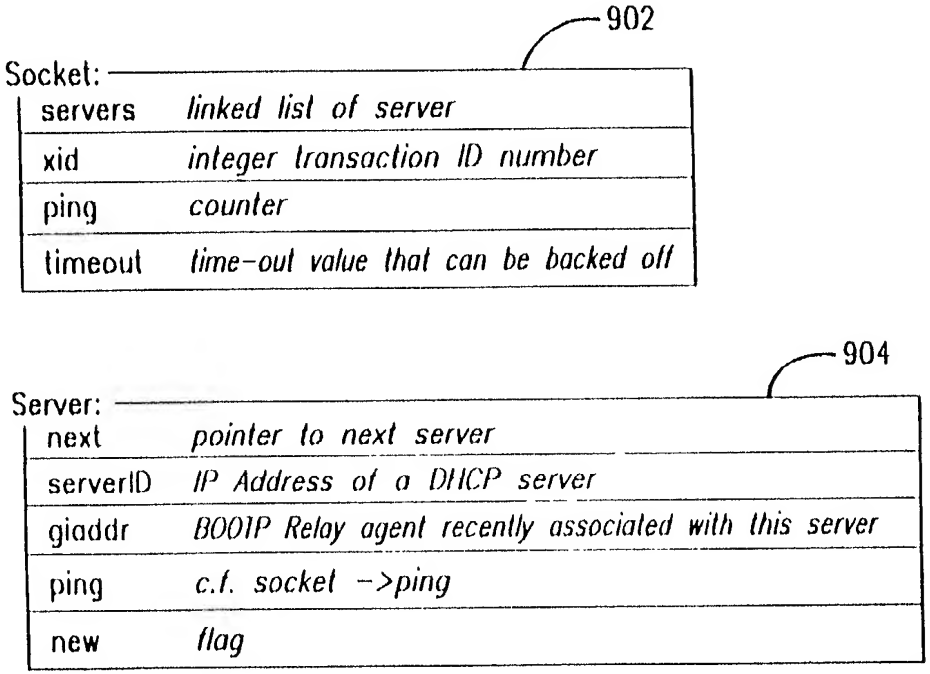


FIG. 16

DHCP Listener Data Structures

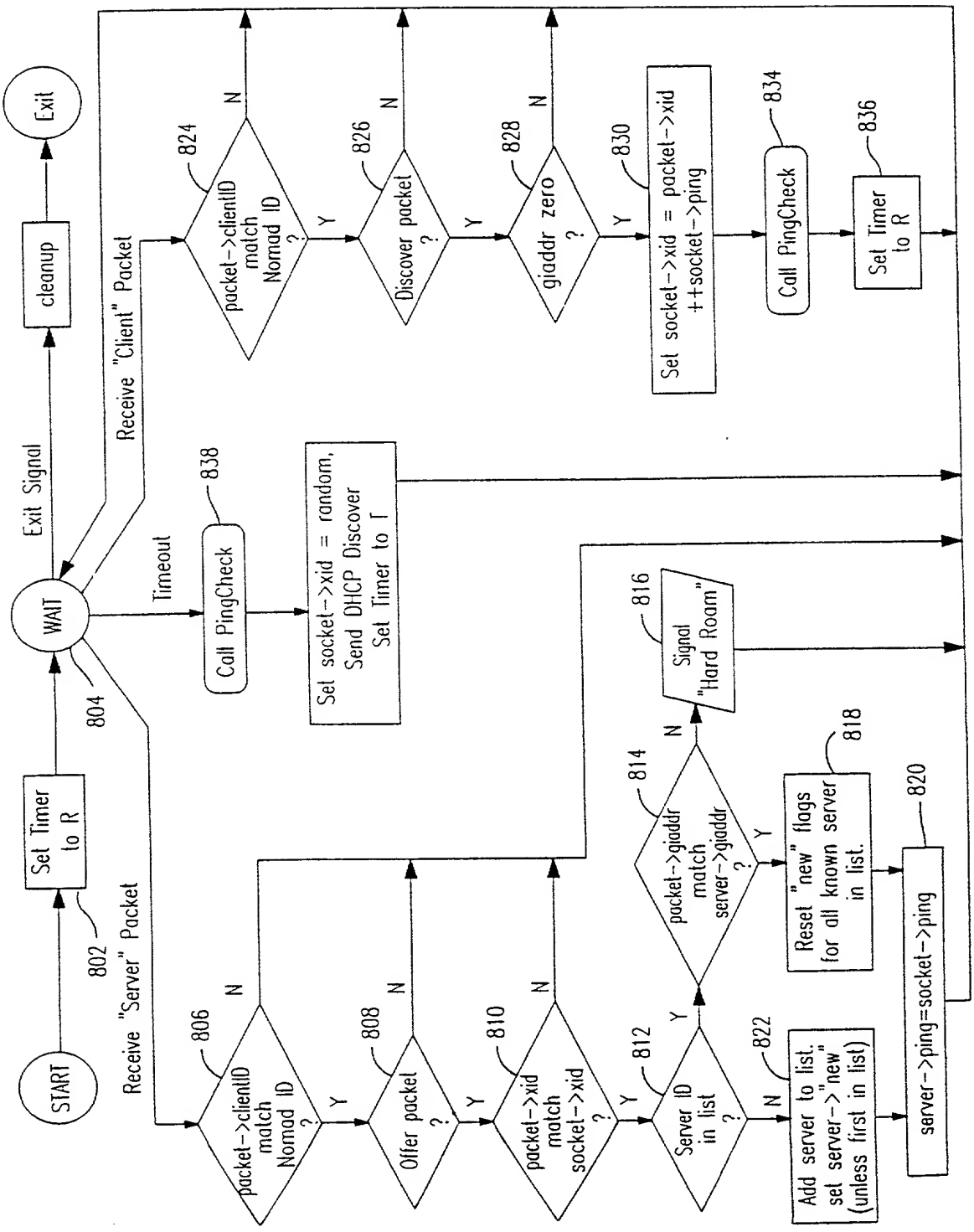
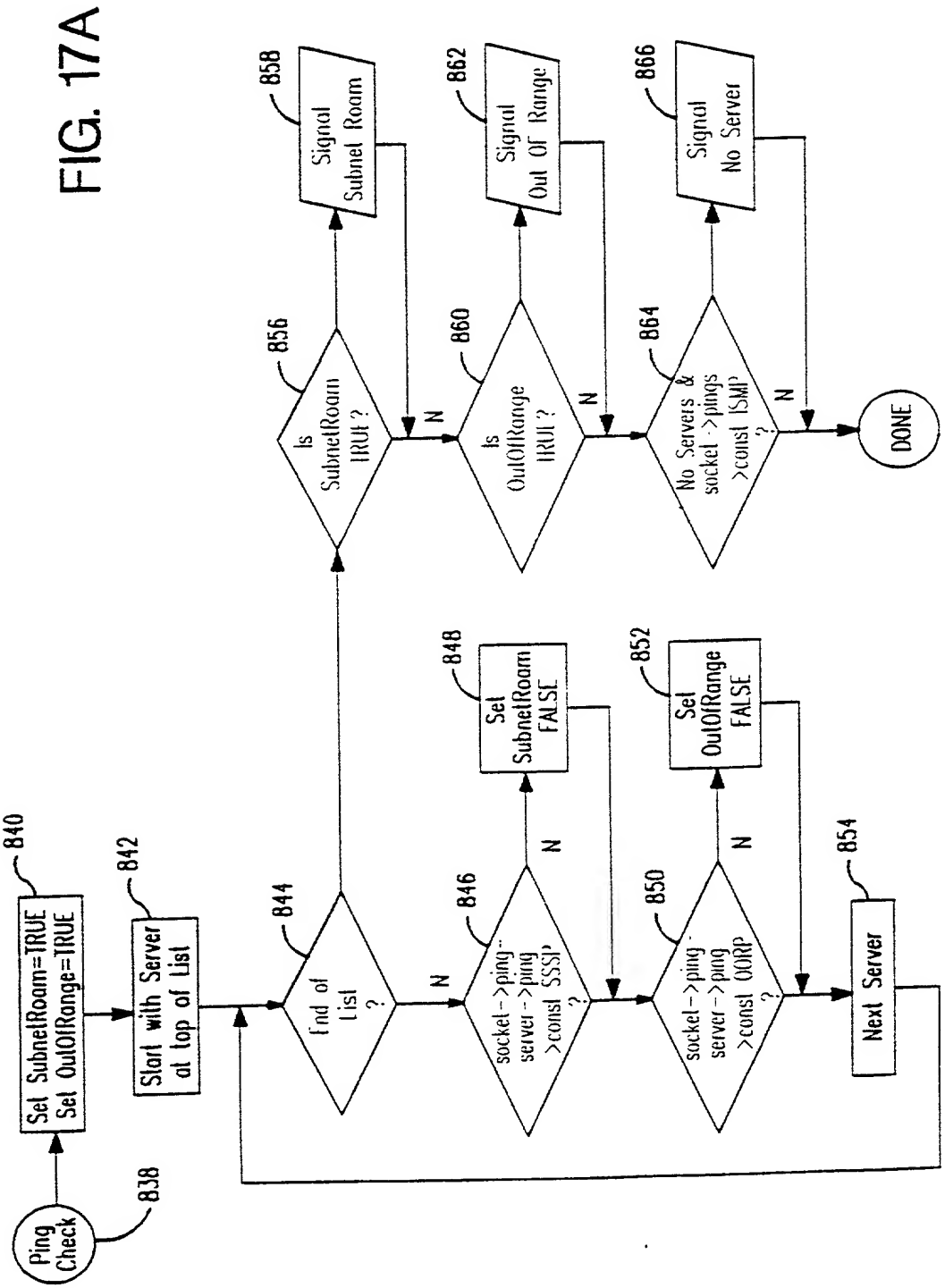

START
Set Timer to R
802
Receive "Server" Packet
804
WAIT
Exit Signal
cleanup
Exit
Timeout
Call PingCheck
838
Set socket->xid = random, Send DHCP Discover Set Timer to T
Receive "Client" Packet
824
packet->clientID match Nomad ID ?
826
Discover packet ?
828
giaddr zero ?
830
Set socket->xid = packet->xid ++socket->ping
834
Call PingCheck
836
Set Timer to R
806
packet->clientID match Nomad ID ?
808
Offer packet ?
810
packet->xid match socket->xid ?
812
Server ID in list ?
814
packet->giaddr match server->giaddr ?
816
Signal "Hard Roam"
818
Reset "new" flags for all known server in list.
820
server->ping=socket->ping
822
Add server to list. set server->"new" (unless first in list)
Y
N

Fig. 17

FIG. 17A


Ping Check
838
Set SubnetRoam=TRUE
Set OutOfRange=TRUE
840
Start with Server at top of List
842
End of List ?
844
N
socket->ping-server->ping >const SSSP ?
846
N
Set SubnetRoam FALSE
848
socket->ping-server->ping >const OORP ?
850
N
Set OutOfRange FALSE
852
Next Server
854
Is SubnetRoam TRUE ?
856
N
Signal Subnet Roam
858
Is OutOfRange TRUE ?
860
N
Signal Out Of Range
862
No Servers & socket->pings >const ISMP ?
864
N
Signal No Server
866
DONE

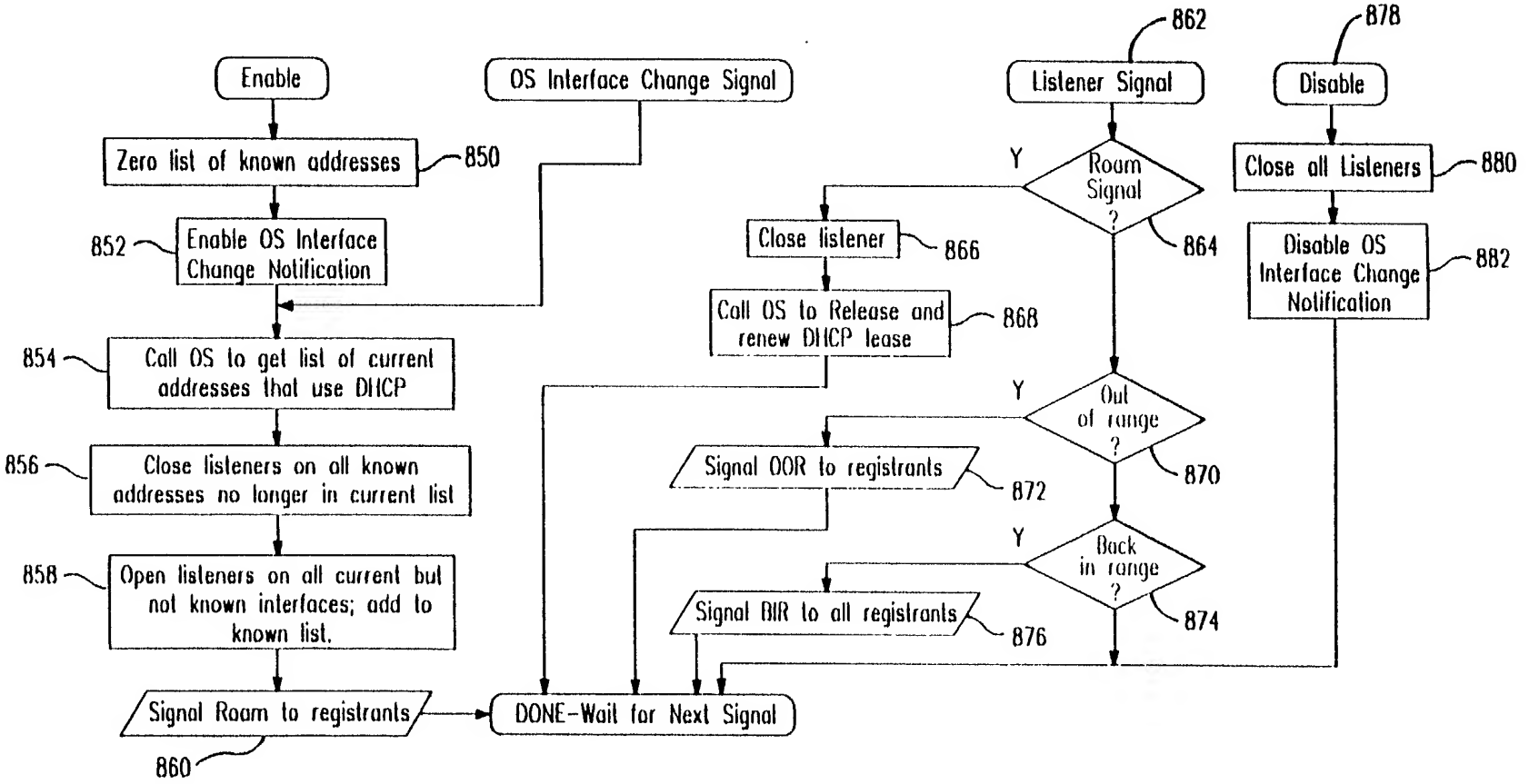


FIG. 18

ROAMING CONTROL CENTER-
Mobile End System

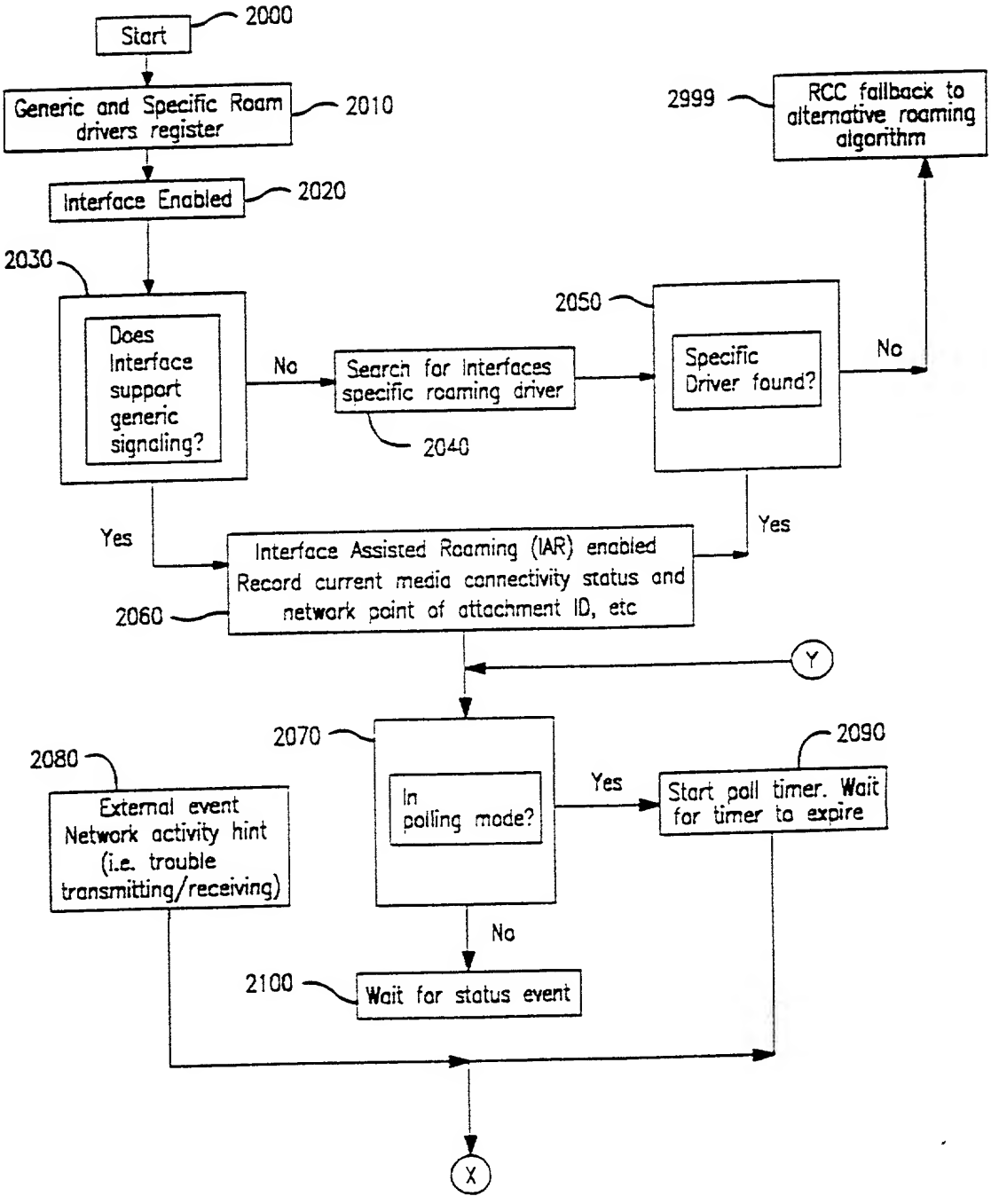
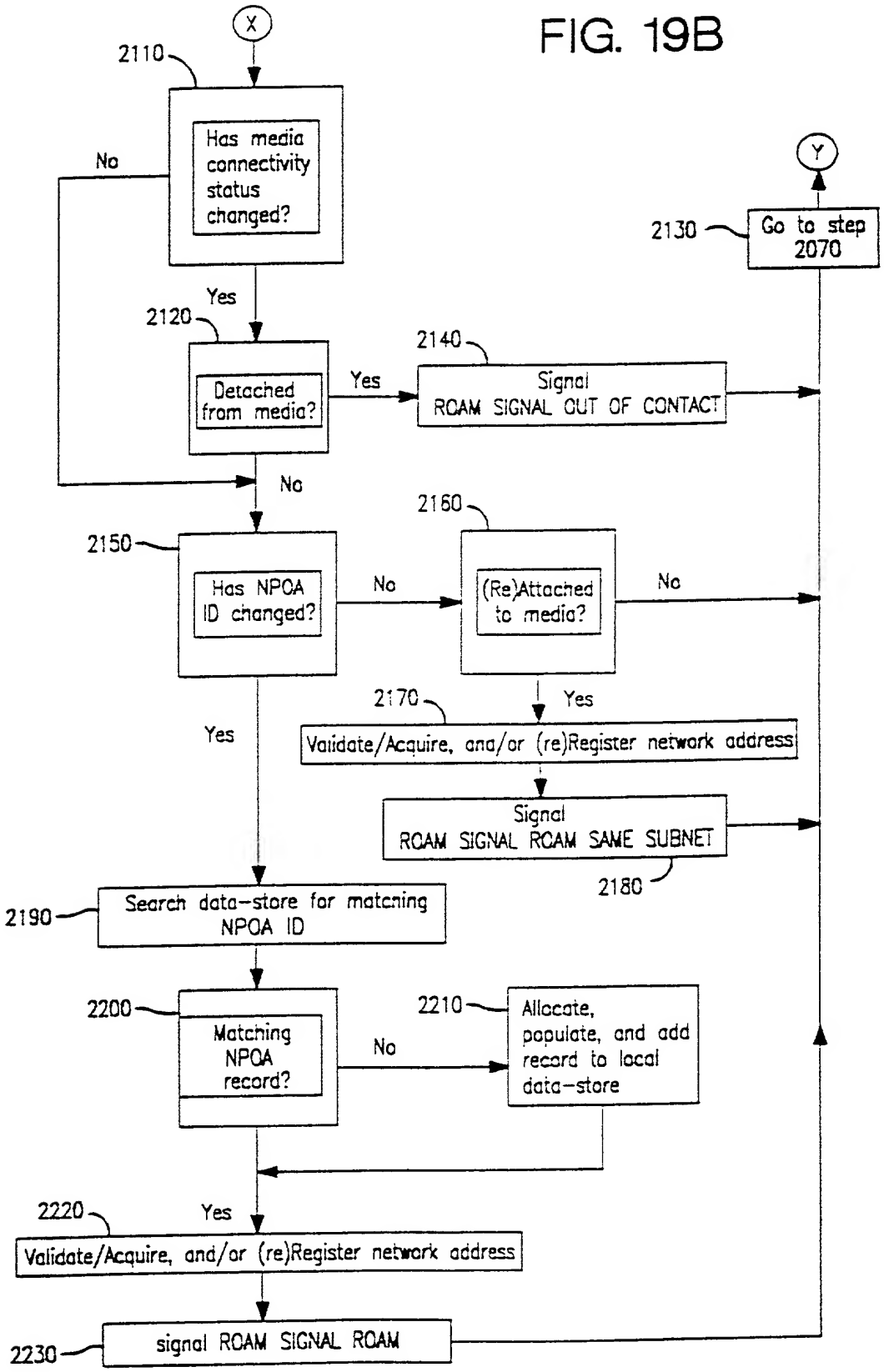


FIG. 19A

Interface Assisted Roaming (IAR) Decision Tree

FIG. 19B


X
2110
Has media connectivity status changed?
No
Yes
2120
Detached from media?
Yes
2140
Signal ROAM SIGNAL OUT OF CONTACT
Y
2130
Go to step 2070
No
2150
Has NPOA ID changed?
No
2160
(Re)Attached to media?
No
Yes
2170
Yes
Validate/Acquire, and/or (re)Register network address
Signal ROAM SIGNAL ROAM SAME SUBNET
2180
Yes
2190
Search data-store for matching NPOA ID
2200
Matching NPOA record?
No
2210
Allocate, populate, and add record to local data-store
2220
Yes
Validate/Acquire, and/or (re)Register network address
2230
signal ROAM SIGNAL ROAM

2960AD' 22E8400E

Next Table Element	Previous Table Element	NPOA Unique Identifier	Network Level Address	Network Mask	Flags (i.e. Static Dynamic, etc.)	Timeout	Etc.
Next Table Element	Previous Table Element	NPOA Unique Identifier	Network Level Address	Network Mask	Flags (i.e. Static Dynamic, etc.)	Timeout	Etc.

•
•
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Next Table Element	Previous Table Element	NPOA Unique Identifier	Network Level Address	Network Mask	Flags (i.e. Static Dynamic, etc.)	Timeout	Etc.

FIG. 20

Interface Assisted Roaming
Topology Node

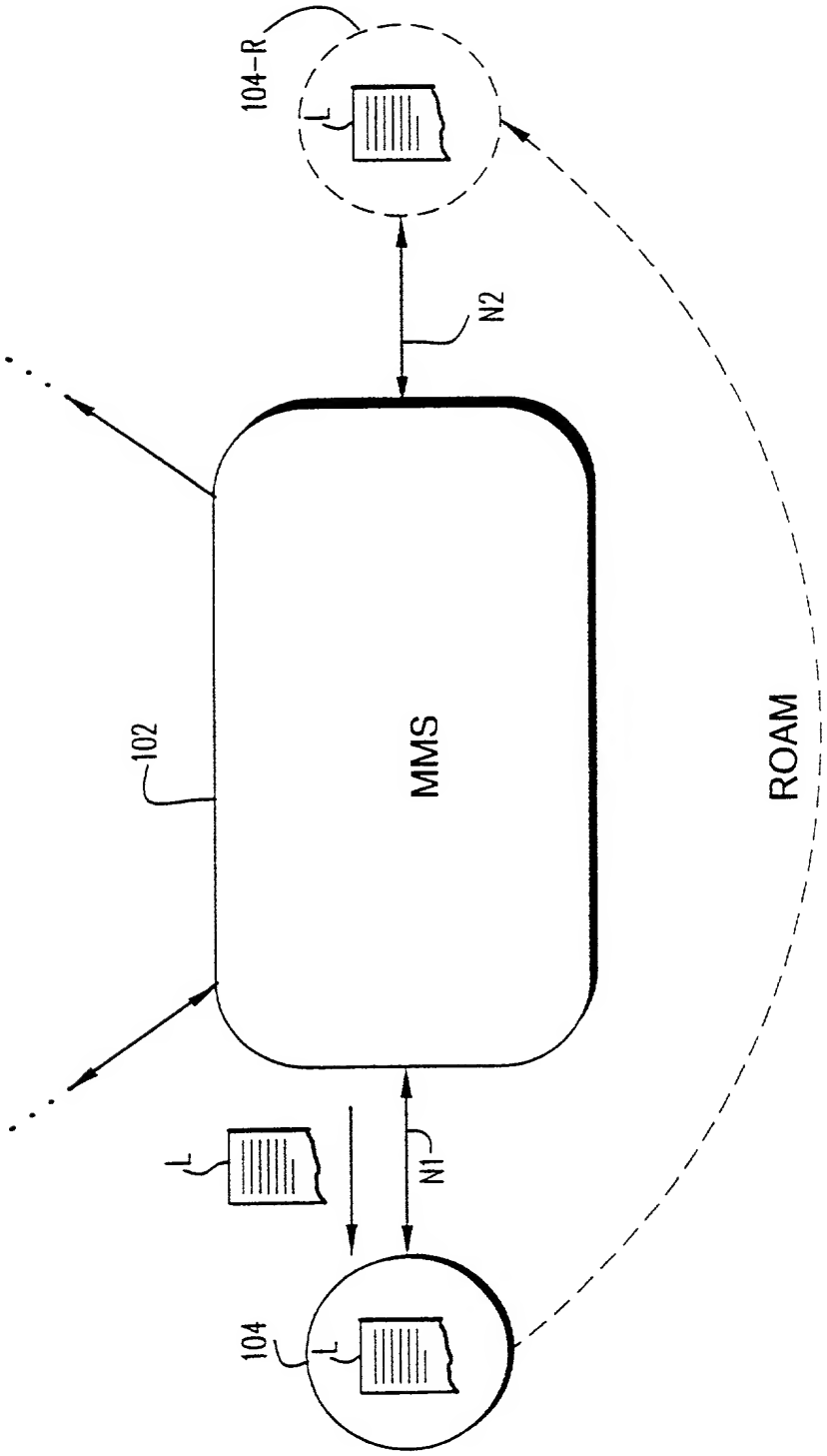

Fig.21

Disjoint network Roaming

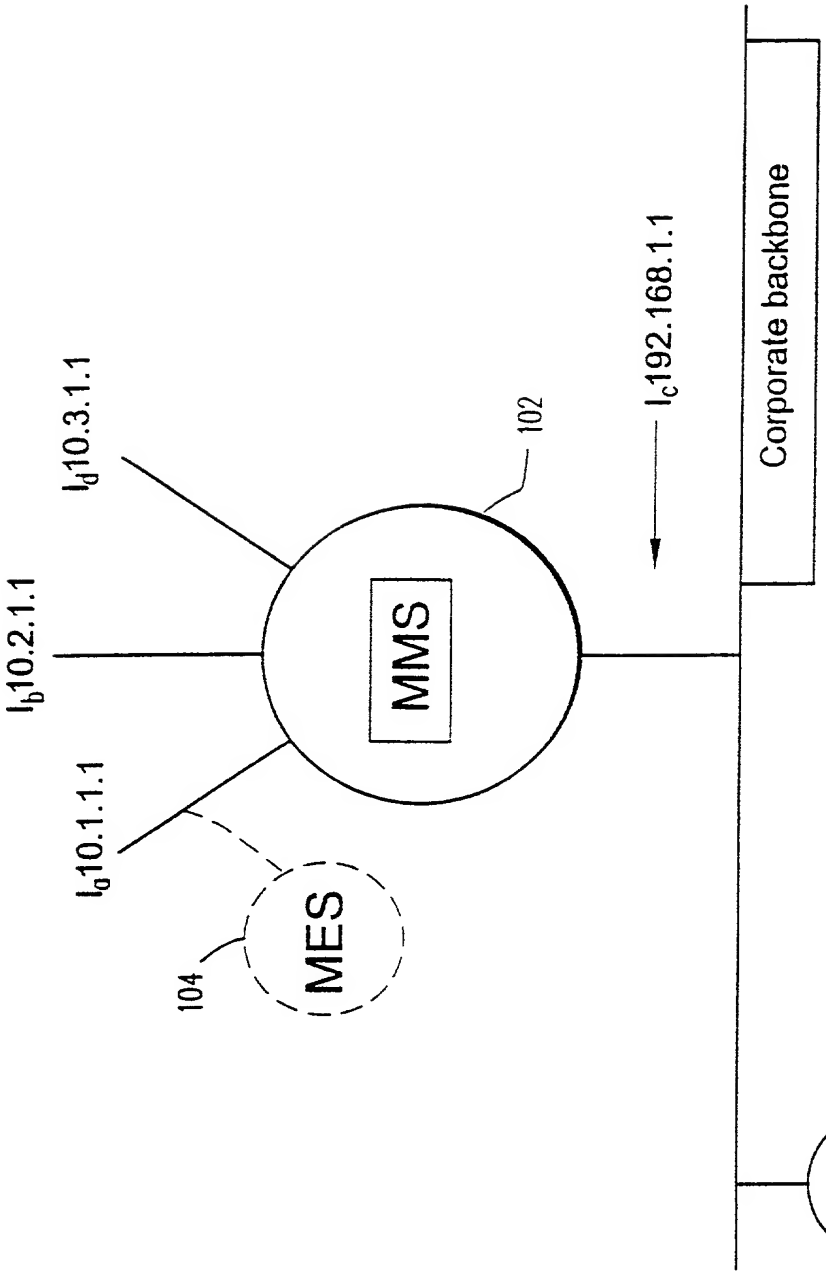

Fig.22

Example Secure Disjoint Coordination

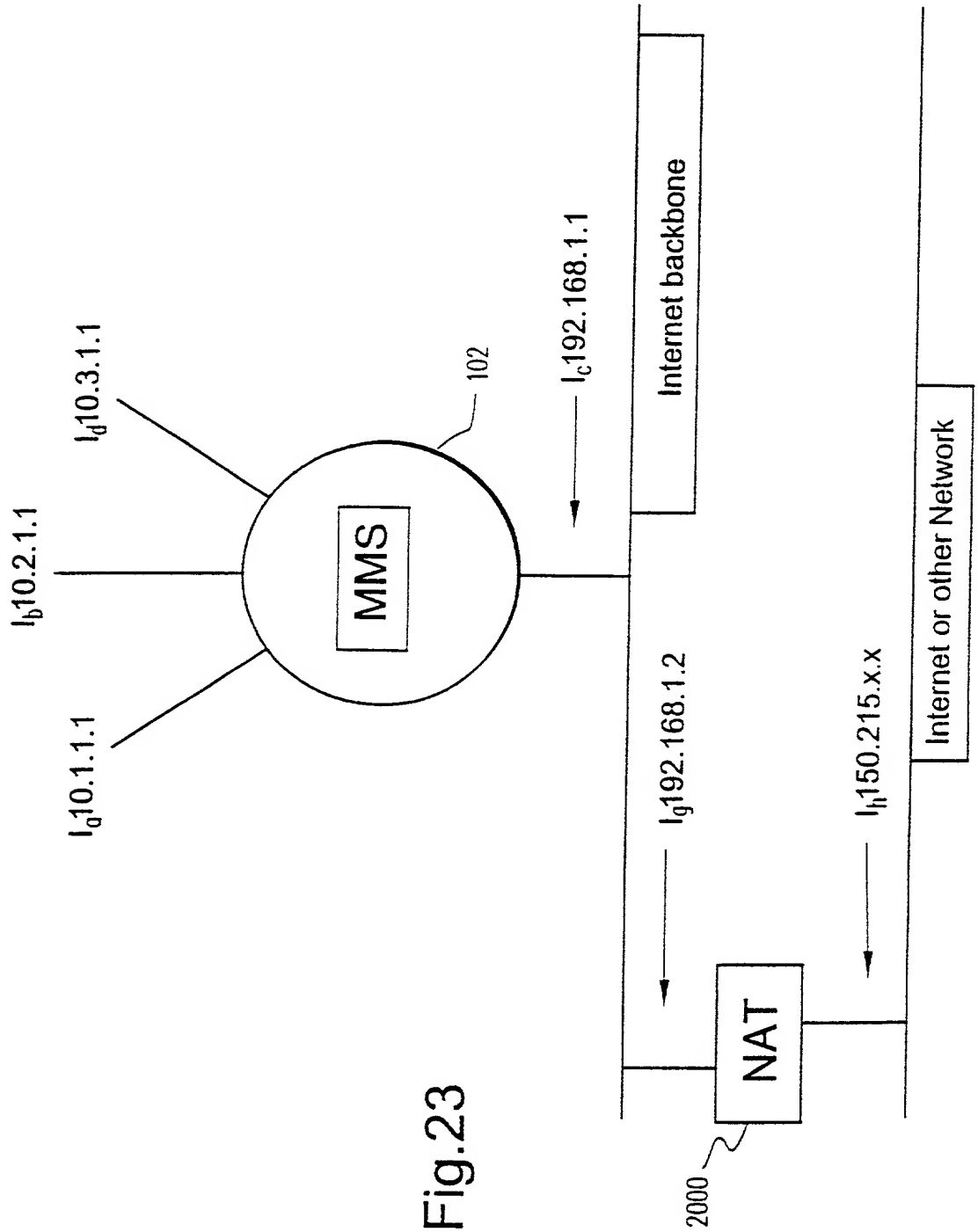
MMS
102
I_b10.2.1.1
I_d10.3.1.1
I_a10.1.1.1
I_c192.168.1.1
Internet backbone
I_g192.168.1.2
I_h150.215.x.x
Internet or other Network
NAT
2000

Fig.23